Environmental Assessment

Waste Treatment Facility

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation.

OWMC TREATMENT FACILITY
FACILITY DESCRIPTION

Prepared by
Monenco Limited
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December 1986

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Ontario Waste Management Corporation
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Attention: Mr. R. V. Griffiths, P.Eng.
Project Manager

Gentlemen,

OWMC Treatment Facility
Monenco Contract No.: MNC 8084-2

Facility Description Report

We are pleased to submit herewith the draft report entitled: Facility Description. The report describes the conceptual design of OWMC's proposed Facility for the treatment and disposal of liquid industrial and hazardous waste in Ontario.

We trust that this report meets the Corporation's requirements.

Yours very truly,

J. V. Fitzgerald, P.Eng.
Project Manager

JVF/jj

TABLE OF CONTENTS

PAGE

TITLE PAGE (i)
LETTER OF TRANSMITTAL (ii)
TABLE OF CONTENTS (iii)

EXECUTIVE SUMMARY i

PURPOSE OF THE REPORT i
SCOPE AND METHOD ii
PREMISES AND POSTULATES iii
STATUS OF DATA vii
MAIN FINDINGS ix

CHAPTER 1 - INTRODUCTION 1

1.1 PURPOSE OF THE REPORT 1
1.2 BACKGROUND INFORMATION 2
1.3 SCOPE OF WORK 4
1.4 REPORT FORMAT 5

CHAPTER 2 - DESIGN BASIS 7

2.1 INTRODUCTION 7
2.2 OWMC OBJECTIVES 7
2.3 OWMC PHILOSOPHY 8
2.4 WASTE PROFILE 10
2.5 TREATMENT PHILOSOPHY 14
2.5.1 INCINERATION PLANT 14

TABLE OF CONTENTS (CONT'D)

PAGE

2.5.2 PHYSICAL/CHEMICAL TREATMENT PLANT 15
2.5.3 SOLIDIFICATION PLANT 16
2.5.4 ENGINEERED LANDFILL 17
2.6 PREMISES 17
2.7 POSTULATES 19
2.8 DESIGN REQUIREMENTS 21

CHAPTER 3 - FACILITY DESCRIPTION AND OPERATION 24

3.1 INTRODUCTION 24
3.2 WASTE DELIVERY 30
3.2.1 WASTE RECEPTION 30
3.2.2 WASTE HANDLING AND STORAGE 33
3.2.2.1 Organic Wastes 33
3.2.2.2 Inorganic Wastes 39
3.2.3 NORMAL OPERATION 42
3.2.3.1 General 42
3.2.3.2 Gatehouse and Weighscales 43
3.2.3.3 Truck Holding Area (Organic and Inorganic) 44
3.2.3.4 Organic Tank Truck Unloading Area 44
3.2.3.5 Incineration Plant 44
3.2.3.6 Segregated Organic Storage Tank Area 45
3.2.3.7 Organic Drum Storage and Handling Building 45
3.2.3.8 Inorganic Tank Truck Unloading Area 46
3.2.3.9 Solidification Plant 46
3.2.3.10 Inorganic Drum Storage and Handling Building 46

TABLE OF CONTENTS (CONT'D)

PAGE

3.2.4 ABNORMAL OPERATION OR UPSET CONDITION 47
  3.2.4.1 Non-Specification Waste 47
  3.2.4.2 Spills and Leaks 48
  3.2.4.3 Power Failure 49
  3.2.4.4 Fire 49
  3.2.4.5 Emergency Provisions 49

3.3 INCINERATION PLANT 50
3.3.1 WASTE STORAGE AND HANDLING 50
  3.3.1.1 Pumpable Liquids and Sludges 54
  3.3.1.2 Dry bulk Solids 54
  3.3.1.3 Drummed Non-Pumpable Wastes 56
  3.3.1.4 Custom Waste Containers 56
3.3.2 ROTARY KILN INCINERATION PLANT 57
  3.3.2.1 Combustion System 57
  3.3.2.2 Flue Gas Cooling System 68
  3.3.2.3 Flue Gas Treatment System 70
  3.3.2.4 Flue Gas Reheating 75
  3.3.2.5 Stack 75
  3.3.2.6 Residue Handling Systems 76
  3.3.2.7 Reagent Storage and Handling Systems 77
  3.3.2.8 Auxiliary Systems 78
  3.3.2.9 Control Centre and Offices 83
  3.3.2.10 Mechanical and Electrical Rooms 85
3.3.3 NORMAL OPERATION 86
  3.3.3.1 General 86
  3.3.3.2 Operational Safety 89
3.3.4 ABNORMAL OPERATION OR UPSET CONDITION 96
  3.3.4.1 Spills and Leaks 96
  3.3.4.2 Power Failure 96

TABLE OF CONTENTS (CONT'D)

PAGE

3.3.4.3 Fire 99
3.3.4.4 Emergency Provisions 99
3.4 PHYSICAL/CHEMICAL TREATMENT PLANT 99
3.4.1 WASTE STORAGE AND HANDLING 99
3.4.2 PHYSICAL/CHEMICAL TREATMENT PLANT 99
3.4.2.1 Inorganic Waste Treatment System 106
3.4.2.2 Aqueous Organic Waste Treatment System 114
3.4.2.3 Miscellaneous Waste Treatment System 118
3.4.2.4 Reagent Storage and Feeding System 120
3.4.2.5 Control Centre, Laboratory and Offices 122
3.4.2.6 Mechanical and Electrical Rooms 124
3.4.3 NORMAL OPERATION 125
3.4.3.1 General 126
3.4.3.2 Treatability Testing 128
3.4.3.3 Process Control Philosphy 130
3.4.3.4 Operational Safety 132
3.4.4 ABNORMAL OPERATION OR UPSET CONDITION 134
3.4.4.1 Spills and Leaks 134
3.4.4.2 Power Failure 134
3.4.4.3 Fire 135
3.4.4.4 Additional Safeguards 135
3.4.5 TYPICAL TREATMENT SEQUENCE 136
3.5 SOLIDIFICATION PLANT 139
3.5.1 FEED STORAGE AND HANDLING 139
3.5.1.1 Filter Cake 144
3.5.1.2 Dry Solids and Wet Non-Pumpable Residues 144

TABLE OF CONTENTS (CONT'D)

PAGE

3.5.1.3 Liquid Residues 145
3.5.1.4 Miscellaneous Clean-Up Material 146
3.5.1.5 Dry Solids and Wet Non-Pumpable Inorganic Wastes 147
3.5.2 HIGH SOLIDS TREATMENT SYSTEM 148
3.5.2.1 Mixers 148
3.5.2.2 Product Discharge Conveyor 149
3.5.3 LOW SOLIDS TREATMENT SYSTEM 149
3.5.4 REAGENTS STORAGE AND HANDLING 150
3.5.4.1 Portland Cement 151
3.5.4.2 (Soluble) Sodium Silicate Solution 151
3.5.4.3 Lime 151
3.5.4.4 Clay 152
3.5.4.5 Flyash 152
3.5.5 INSTRUMENTS AND CONTROLS 152
3.5.6 NORMAL OPERATION 153
3.5.6.1 General 154
3.5.6.2 Treatability Tests 156
3.5.6.3 Operational Safety 156
3.5.7 ABNORMAL OPERATION OR UPSET CONDITION 158
3.5.7.1 Spills and Leaks 158
3.5.7.2 Power Failure 158
3.5.7.3 Fire 159
3.5.7.4 Emergency Provisions 159
3.6 ENGINEERED LANDFILL 160
3.6.1 LANDFILL DESIGN 160
3.6.2 ENGINEERED DEVICES 160
3.6.2.1 Simple Cover 160
3.6.2.2 Native Clay Base 163
3.6.2.3 Underdrain Leachate Collection System 163

TABLE OF CONTENTS (CONT'D)

PAGE

3.6.3 FACILITIES AND SERVICES 163
  3.6.3.1 Solidified Material Handling 164
  3.6.3.2 Landfill Access Roads 164
  3.6.3.3 Surface Drainage 165
3.6.4 NORMAL OPERATION 166
  3.6.4.1 General 166
3.7 GENERAL FACILITIES 167
3.7.1 FACILITY LAYOUT 168
3.7.2 TANK TRUCK UNLOADING 168
3.7.3 INCINERATOR TANK FARM AND PHYSICAL/ CHEMICAL STORAGE TANK AREA 168
  3.7.3.1 Incinerator Tank Farm 168
  3.7.3.2 Physical/Chemical Storage Tank Area 177
  3.7.3.3 Normal Operation 182
  3.7.3.4 Abnormal Operation or Upset Condition 183
3.7.4 DRUM STORAGE AND HANDLING 185
  3.7.4.1 Organic Drum Storage and Handling Building 185
  3.7.4.2 Inorganic Drum Storage and Handling Building 191
  3.7.4.3 Normal Operation 195
  3.7.4.4 Abnormal Operation or Upset Condition 196
3.7.5 UTILITIES, SERVICES AND BUILDINGS 197
  3.7.5.1 Site Services 198
  3.7.5.2 Utility Systems 199
  3.7.5.3 Buildings 209
3.7.6 DATA MANAGEMENT SYSTEM AND PROCESS CONTROL 211
  3.7.6.1 Data Management System 212
  3.7.6.2 Process Control 214

TABLE OF CONTENTS (CONT'D)

PAGE

3.7.7 ELECTRICAL SYSTEMS AND COMMUNICATIONS 216
  3.7.7.1 Main Substation and Power Distribution Systems 216
  3.7.7.2 Emergency and Uninterruptible Power Supply 218
  3.7.7.3 Lighting System 221
  3.7.7.4 Grounding System 222
  3.7.7.5 Lightning Protection System 223
  3.7.7.6 Communications 224
  3.7.7.7 Hazardous Area Classification 227
  3.7.7.8 Fire Alarm and Detection 227
3.7.8 FIRE PROTECTION 232
3.7.9 VENT EMISSION CONTROL AND NITROGEN BLANKETTING SYSTEMS 237
  3.7.9.1 Organic Emission Control 238
  3.7.9.2 Inorganic Emission Control 240
  3.7.9.3 Operation 241
3.7.10 TRUCK WASH 242
3.7.11 LABORATORIES 244
  3.7.11.1 Main Laboratory 244
  3.7.11.2 Physical/Chemical Laboratory 250
3.7.12 SAFETY AND SECURITY 254
  3.7.12.1 Engineered Containment 254
  3.7.12.2 Fire Protection 255
  3.7.12.3 Ventilation Systems 255
  3.7.12.4 Safety Showers, Eyebaths and Breathing Apparatus 255
  3.7.12.5 Plant Security 255

CHAPTER 4 - ENVIRONMENTAL CONSIDERATIONS 257

4.1 INTRODUCTION 257

TABLE OF CONTENTS (CONT'D)

PAGE

4.2 ENGINEERING FEATURES 258
  4.2.1 EMISSIONS 258
    4.2.1.1 Flue Gas Emissions from the Incineration Plant Stack 259
    4.2.1.2 Steam Emissions from the Evaporator Stack 261
    4.2.1.3 Fugitive Atmospheric Emissions 266
  4.2.2 LANDFILL LEACHATE 268
  4.2.3 SURFACE DRAINAGE 268
    4.2.3.1 Central Operating Area 268
    4.2.3.2 Engineered Landfill 271
  4.2.4 SPILL CONTROL/DETECTION/CLEAN UP 272
    4.2.4.1 Bulk Waste Unloading Areas 272
    4.2.4.2 Outdoor Tank Storage Areas 273
    4.2.4.3 Indoor Tank Storage Areas 274
    4.2.4.4 Process Areas 275
    4.2.4.5 Ponds 275
  4.2.5 FIRE PROTECTION 276
  4.2.6 MONITORING 277
    4.2.6.1 On-Site Monitoring 277
  4.2.7 DECOMMISSIONING 282

CHAPTER 5 - FACILITY CHARACTERISTICS INFORMATION 283

5.1 INTRODUCTION 283
  5.1.1 BASELINE MONITORING 284
    5.1.1.1 Atmospheric 284
    5.1.1.2 Hydrogeologic 284
  5.1.2 CONSTRUCTION OF THE FACILITY 284
  5.1.3 INITIAL START-UP OF THE FACILITY 286

TABLE OF CONTENTS (CONT'D)

PAGE

5.1.4 OPERATION OF THE FACILITY 287

5.1.4.1 Transportation Requirements 287

5.1.4.2 Emissions and Effluents 288

5.1.4.3 Engineered Containment 289

5.1.4.4 Anticipated Noise Levels 289

5.1.4.5 Visual Appearance 290

5.1.4.6 Dust 292

5.1.4.7 Hours of Operation 294

5.1.4.8 Employment Levels 295

5.1.4.9 Services for the Facility 295

CHAPTER 6 - PROJECT EXECUTION 307

6.1 PRCJECT PLANNING AND MANAGEMENT 307

6.1.1 ENGINEERING 307

6.1.2 PROCUREMENT 309

6.1.3 CONSTRUCTION 310

6.1.4 QUALITY ASSURANCE 311

6.2 SCHEDULE 313

6.3 COSTS 315

REFERENCES 316

TABLE OF CONTENTS (CONT'D)

LIST OF FIGURES

PAGE

FIGURES

1.1 FACILITIES DEVELOPMENT PROCESS 2

3.1 PERSPECTIVE OF CENTRAL OPERATING AREA 25

3.2 ARRANGEMENT OF CENTRAL OPERATING AREA 26

3.3 SITE PLAN 27

3.4 SERVICE CONNECTIONS 28

3.5 PICTORIAL FLOW DIAGRAM - OVERALL FACILITY - TYPICAL OPERATION 29

3.6 PICTORICAL FLOW DIAGRAM - WASTE HANDLING AND STORAGE 31

3.7 ORGANIC UNLOADING STATION - LIQUIDS AND SLUDGES - PICTORIAL SCHEMATIC 35

3.8 INORGANIC BULK WASTE UNLOADING - PICTORIAL SCHEMATIC 40

3.9 PICTORIAL FLOW DIAGRAM - INCINERATION 51

3.10 INCINERATION PLANT - CONCEPTUAL EQUIPMENT LAYOUT - PLAN 52

3.11 INCINERATION PLANT - CONCEPTUAL EQUIPMENT LAYOUT - SECTIONS 53

3.12 INCINERATION PLANT - OPERATING PHILOSOPHY SCHEMATIC 87

3.13 PICTORICAL FLOW DIAGRAM - PHYSICAL/CHEMICAL TREATMENT PLANT 101

3.14 PHYSICAL/CHEMICAL TREATMENT PLANT - CONCEPTUAL EQUIPMENT LAYOUT - GROUND FLOOR PLAN 102

3.15 PHYSICAL/CHEMICAL TREATMENT PLANT - CONCEPTUAL EQUIPMENT LAYOUT - MEZZANINE FLOOR PLAN 103

3.16 PHYSICAL/CHEMICAL TREATMENT PLANT - CONCEPTUAL EQUIPMENT LAYOUT - SECOND FLOOR PLAN 104

TABLE OF CONTENTS (CONT'D)

LIST OF FIGURES

PAGE

FIGURES

3.17 PHYSICAL/CHEMICAL TREATMENT PLANT - CONCEPTUAL EQUIPMENT LAYOUT - SECTIONS 105
3.18 PHYSICAL/CHEMICAL TREATMENT PLANT - OPERATING PHILOSOPHY SCHEMATIC 127
3.19 PICTORIAL FLOW DIAGRAM - SOLIDIFICATION 140
3.20 SOLIDIFICATION PLANT - CONCEPTUAL EQUIPMENT LAYOUT - PLAN 141
3.21 SOLIDIFICATION PLANT - CONCEPTUAL EQUIPMENT LAYOUT SECTIONS 142
3.22 SOLIDIFICATION PLANT - CONCEPTUAL EQUIPMENT LAYOUT SECTIONS 143
3.23 SOLIDIFICATION PLANT - OPERATING PHILOSOPHY SCHEMATIC 155
3.24 INITIAL LANDFILL DEVELOPMENT AREA 161
3.25 PROFILE THROUGH LANDFILL WORKING AREA 162
3.26 DIAGRAMMATIC ARRANGEMENT OF INCINERATOR TANK FARM 169
3.27 INCINERATOR TANK FARM - CONCEPTUAL LAYOUT - PLAN 171
3.28 DIAGRAMMATIC ARRANGEMENT OF PHYSICAL/CHEMICAL TANK STORAGE 178
3.29 PHYSICAL/CHEMICAL STORAGE TANK AREA - CONCEPTUAL EQUIPMENT LAYOUT - PLAN 179
3.30 DIAGRAMMATIC ARRANGEMENT OF ORGANIC DRUM HANDLING 186
3.31 ORGANIC DRUM STORAGE AND HANDLING BUILDING - CONCEPTUAL EQUIPMENT LAYOUT - PLAN 187
3.32 DIAGRAMMATIC ARRANGEMENT OF INORGANIC DRUM HANDLING 192
3.33 INORGANIC DRUM STORAGE AND HANDLING BUILDING - CONCEPTUAL EQUIPMENT LAYOUT - PLAN AND SECTIONS 193
3.34 TANK TRUCK WASHING FACILITY - PICTORIAL SCHEMATIC 243
6.1 PROPOSED PROJECT ORGANIZATION CHART 308
6.2 PROPOSED SCHEDULE 314

TABLE OF CONTENTS (CONT'D)

LIST OF TABLES

TABLE		PAGE
2.1	CANDIDATE WASTES FOR TREATMENT	13
3.1	HAZARDOUS AREA CLASSIFICATION	228
3.2	FIRE PROTECTION SYSTEM EQUIPMENT	234
3.3	LABORATORY FUNCTIONS AT STAGES OF WASTE TREATMENT	245
3.4	MAIN LABORATORY - MAJOR EQUIPMENT AND INSTRUMENTATION	248
3.5	PHYSICAL/CHEMICAL LABORATORY - MAJOR EQUIPMENT AND INSTRUMENTATION	252
4.1	EXPECTED FLUE GAS EMISSIONS	260
4.2	ESTIMATED EVAPORATOR EMISSIONS	263
5.1	TRANSPORTATION QUANTITIES OF SPECIAL WASTES	296
5.2	TRANSPORTATION QUANTITIES - ADDITIVES, REAGENTS AND EXCAVATED MATERIAL	297
5.3	BUILDING AND POND SIZES - FACILITY CAPACITY 150 000 t/a	299
5.4	DUST SOURCES FROM MATERIAL DELIVERIES TO THE FACILITY	300
5.5	DUST SOURCES FROM MATERIAL TRANSFERS WITHIN THE FACILITIES	302
5.6	EMPLOYMENT LEVELS	303
5.7	SUMMARY OF SERVICES TO SITE	306

TABLE OF CONTENTS (CONT'D)

APPENDICES

APPENDIX A - WASTE QUANTITIES AND CHARACTERISTICS

APPENDIX B - ENVIRONMENTAL MONITORING PROGRAM

B.1 ENVIRONMENTAL MONITORING PROGRAM - GENERAL
B.2 ENVIRONMENTAL MONITORING PROGRAM - ORGANIC WASTE HANDLING
B.3 ENVIRONMENTAL MONITORING PROGRAM - INORGANIC WASTE HANDLING
B.4 ENVIRONMENTAL MONITORING PROGRAM - INCINERATOR TANK FARM
B.5 ENVIRONMENTAL MONITORING PROGRAM - INCINERATION PLANT
B.6 ENVIRONMENTAL MONITORING PROGRAM - PHYSICAL/CHEMICAL TREATMENT PLANT
B.7 ENVIRONMENTAL MONITORING PROGRAM - SOLIDIFICATION PLANT
B.8 ENVIRONMENTAL MONITORING PROGRAM - LANDFILL AREA
B.9 ENVIRONMENTAL MONITORING PROGRAM - CENTRAL OPERATING AREA

APPENDIX C - FACILITY CHARACTERISTICS INFORMATION

C.1 OFF-SITE TIE-INS
C.2 FACILITY NOISE

EXECUTIVE SUMMARY

PURPOSE OF THE REPORT

The purpose of this report is to document the technical features of Ontario Waste Management Corporation's (OWMC) proposed Facility for the treatment of liquid industrial and hazardous waste (special waste). This report is an integral part of OWMC's environmental assessment submission.

The Facility will include a rotary kiln incineration plant for the treatment of organic wastes, a physical/chemical treatment plant for the treatment of inorganic wastes, a solidification plant to further treat the treatment residues and an engineered landfill for the safe disposal of solidified residues. Separate Process Area Reports (Ref: Monenco Limited[9,10,11,12,13]) deal with the selection and optimization of technologies proposed in the areas of incineration, physical/chemical treatment, solidification and engineered landfill, and in the remaining parts of the Facility referred to as general facilities.

This report was prepared for OWMC by Monenco Limited who, as OWMC's engineering consultants, are responsible for the preliminary engineering of the overall Facility.

SCOPE AND METHOD

This report documents the following:

- Philosophies established for the design and operation of OWMC's Treatment Facility.

- Description of the proposed conceptual design and operation of the Facility.

- Environmental considerations associated with the design and operation of the Facility.

- Characteristics of the Facility which established the technical basis for site assessment.

- An execution plan for the engineering, procurement and construction of the Facility including scheduling and cost estimates.

The conceptual design for the Facility was based on technology selection and optimization described in the Process Area Reports utilizing expertise from OWMC consultants and Monenco Limited sub-consultants (Ref: Monenco Limited[9,10,11,12,13]).

In addition, three operating scenarios (typical operation, high effluent and high solidified waste scenarios) were developed (p. 20) to take account of expected variations in the waste characteristics, for establishing the conceptual design and facility characteristics.

PREMISES AND POSTULATES

As a provincial Crown agency, OWMC has, as its mandate, the implementation of a province-wide program for the management of liquid industrial waste and hazardous waste (Ref: OWMC[1]). OWMC's primary responsibility is to establish and operate a liquid industrial waste and hazardous waste (special waste) management system in Ontario (Ref: OWMC[3]). It has no responsibility for managing municipal solid waste or radioactive waste, nor is it a regulator of other industrial waste management systems (Ref: OWMC[3]).

OWMC has developed basic planning principles and guidelines which are central to the technology selection and conceptual design of the proposed treatment Facility. The following points summarize these philosophies:

- It is the Corporation's goals to:
    - minimize risk to human health,
    - minimize environmental impacts, and
    - minimize financial costs to OWMC and the people of Ontario.

- OWMC facilities, no matter how large or small they ultimately may be, must be designed to handle all types of special waste identified as requiring treatment. This full service responsibility is inherent in the concept of OWMC as a crown agency (Ref: OWMC[3]).

- Special waste must undergo treatment to the fullest possible extent using the world's best proven technology, and the remaining residues must receive the most secure containment possible (Ref: OWMC[3]).

- No hazardous waste will be placed untreated in a secure landfill (Ref: OWMC[1]).

PREMISES

The following additional premises provided by OWMC have been used as starting points for the conceptual design of the Facility.

- The OWMC Treatment Facility will be designed as an integrated Facility, located in the Township of West Lincoln, in the Regional Municipality of Niagara.

- The initial treatment and disposal facilities will consist of:
  - a rotary kiln incineration plant,
  - a physical/chemical treatment plant (including solidification), and
  - an engineered landfill.

- OWMC's Treatment Facility will be designed with an initial capacity of 150 000 t/a, with provisions for future expansion up to 300 000 t/a if necessary. The initial capacity of 150 000 t/a of special waste would consist of approximately 30 000 t/a of organic waste and 120 000 t/a of inorganic waste.

- Build up of special waste quantities in a staged manner to 150 000 t/a in the fifth year of operation and 300 000 t/a in the tenth year of operation as follows:

Year of Operation	Total (t/a)	Inorganic (t/a)	Organic (t/a)
1	50 000	30 000	20 000
2	70 000	50 000	20 000
3	105 000	80 000	25 000
4	130 000	100 000	30 000
5	150 000	120 000	30 000
6	180 000	144 000	36 000
7	210 000	168 000	42 000
8	240 000	192 000	48 000
9	270 000	216 000	54 000
10	300 000	240 000	60 000

- November 1984 waste profile and waste characterization data.

- Variations in the types and quantities of special wastes requiring treatment at OWMC's Treatment Facility may result from:
  - effectiveness of OWMC's 4R program, which is to encourage industry in Ontario to Reduce, Recover, Recycle and Reuse industrial waste,
  - industry's response to market demands and to financial constraints,
  - process and manufacturing changes, and
  - changes in Provincial waste regulations.

- Due to expected variations in the types and quantities of special wastes requiring treatment at OWMC's Treatment Facility, it is necessary that the facility conceptual design incorporate features such as:
  - maximum flexibility,
  - future expansion capability, and
  - reserve storage and treatment capacity.

- No wastes will normally be accepted at the Facility unless they have been previously tested and analysed by OWMC's laboratory to determine their physical and chemical characteristics, to identify the treatment processes required and to establish how and when the wastes will be shipped to the Facility for treatment. This does not preclude exceptional circumstances such as the emergency clean-up of spills or instances where it is safer to store hazardous wastes at OWMC's Facility than elsewhere, pending determination of treatment and disposal methods.

- Only proven technologies will be considered for OWMC's Treatment Facility. Technologies will be considered "proven" if they have commercially demonstrated to perform reliably for a period of at least 12 months on a scale and in a manner comparable with that required for the OWMC Facility.

- Procedures which were established by OWMC for the delivery, reception and handling of special waste.

Further premises, which were established as the starting point for the development of the conceptual design, are detailed in the Process Area Reports (Ref: Monenco Limited[9,10,11,12,13]).

POSTULATES

Postulates are assumptions or hypotheses formulated by Monenco or OWMC's consultants, which are basic to the approach used to develop the conceptual design of the Facility, and are listed as follows:

- Waste quantities and characteristics (eg. inorganic/organic pumpable liquids, sludges and non-pumpables), developed from waste data provided by OWMC, are presented in Appendix A, and summarized in Table 2.1 (p. 13).

- Three operating scenarios (typical operation, high effluent and high solidified waste scenarios (p. 20) to take account of expected variations in the waste characteristics.

Further postulates, which were established as the basis for the conceptual design, are detailed in the Process Area Reports (Ref: Monenco Limited[9,10,11,12,13]).

STATUS OF DATA

The conceptual design and facility characteristics information presented in this report were based on the following:

- Incineration Plant technology selection and optimization addressed in Process Area Report - Incineration (Ref: Monenco Limited[9]).

- Physical/Chemical Treatment Plant technology and optimization addressed in Process Area Report - Physical/Chemical Treatment (Ref: Monenco Limited[10]).

- Solidification Plant technology selection and optimization addressed in Process Area Report - Solidification (Ref: Monenco Limited[11]).

- Engineered Landfill technology selection and optimization addressed in Process Area Report - Engineered Landfill (Ref: Monenco Limited[12]).

- General Facilities technology selection and optimization addressed in Process Area Report - General Facilities (Ref: Monenco Limited[13]).

- Input provided by other OWMC consultants and Monenco sub-consultants having specialized knowledge and experience as follows:

  Incineration
  - Environmental Elements Corporation, Baltimore, Maryland, USA,
  - Von Roll, Zurich, Switzerland, and
  - Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany.

  Physical/Chemical Treatment
  - Environmental Elements Corporation, Baltimore, Maryland, USA, and
  - Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany.

  Solidification
  - J. R. Conner Technologies, Atlanta, Georgia, USA.

  Engineered Landfill
  - M. M. Dillon Limited, Toronto, Ontario.

  General Facilities
  - Environmental Elements Corporation, Baltimore, Maryland, USA,
  - Von Roll, Zurich, Switzerland,
  - Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany, and
  - Reed Stenhouse Limited, Toronto, Ontario.

Modifications to the conceptual design may be required:

- Where ongoing environmental impact assessment studies indicate that mitigation may be required, and/or

- Where presubmission consultation identifies concerns that should be mitigated,

and these will be documented in the final Facility Description report.

Capital and operating cost estimates will be documented in the final Facility Description report.

MAIN FINDINGS

OWMC's Treatment Facility comprises:

- a rotary kiln incineration plant,
- a physical/chemical treatment plant (including solidification), and
- an engineered landfill.

The Facility has an initial capacity of 150 000 t/a with provision for future expansion up to an ultimate capacity of 300 000 t/a.

DESIGN AND OPERATION

The main design and operational features of the proposed Facility are:

INCINERATION PLANT

The rotary kiln incineration plant which is proposed for OWMC's incineration plant consists of the following main components:

- Combustion System:
  - rotary kiln incinerator, with
  - secondary combustion chamber.

- Flue Gas Cooling System:
  - waste heat recovery boiler.

- Flue Gas Treatment System:
  - spray dryer,
  - electrostatic precipitator, and
  - three stage wet scrubber.

PHYSICAL/CHEMICAL TREATMENT PLANT

The physical/chemical treatment plant incorporates three process treatment systems corresponding to the three categories of waste which are expected to require physical/chemical treatment as follows:

- An inorganic treatment system designed to treat inorganic special wastes delivered to the Facility plus inorganic wastes generated on site such as ventilation air scrubber blowdown, truck wash water and flushing water.

- An aqueous organic treatment system designed to treat selected aqueous organic wastes plus dilute organic containing wastes generated on site such as truck wash water and flush water containing organic contaminants.

- A miscellaneous treatment system designed to treat landfill leachate and contaminated surface drainage.

The inorganic treatment system consists of the following unit processes:

- Primary treatment:
  - phase separation,
  - dissolution/slurrying, and
  - blending.

- Secondary treatment:
  - oxidation/reduction,
  - neutralization/precipitation,
  - coagulation/sedimentation, and
  - sludge dewatering.

- Intermediate storage.

- Effluent polishing:
  - granular media filtration,
  - activated carbon adsorption, and
  - reverse osmosis.

- Final treated effluent storage.

- Evaporation.

Evaporation serves a dual role in the treatment system as a treatment step for removing high (>4 % by weight) total dissolved solids concentrations from partially treated effluents prior to reuse and in addition, provides the means for disposing of excess treated effluent which cannot be reused on site.

The aqueous organic treatment system consists of the following unit processes:

- Primary treatment:
  - phase separation, and
  - blending.

- Secondary treatment:
  - emulsion breaking,
  - centrifugation, and
  - dissolved air flotation.

- Polishing:
  - activated carbon adsorption.

- Intermediate storage.

From intermediate storage, batches of partially treated aqueous organic wastes receive additional secondary and/or effluent polishing treatment in the inorganic treatment system.

The miscellaneous treatment system consists of the following unit processes:

- Primary/secondary treatment:
  - equalization,
  - neutralization/precipitation,
  - flocculation/sedimentation, and
  - sludge dewatering.

- Effluent polishing:
  - granular media filtration,
  - activated carbon adsorption, and
  - reverse osmosis.

- Final treated effluent storage.

- Evaporation

SOLIDIFICATION PLANT

The solidification plant incorporates two process treatment systems corresponding to the categories of residues which require solidification treatment as follows:

- High solids treatment system utilizing Portland cement based technologies with minor additives (lime, clay, flyash and soluble silicate) for the solidification of certain high solids content residues.

- Low solids treatment system utilizing Portland cement/soluble silicate technology for the solidification of low solids content liquid residues.

ENGINEERED LANDFILL

The engineered landfill comprises:

- shallow entombed landfill concept,
- system of devices consisting of a native clay base, simple cover and underdrain, and
- area method of development.

GENERAL FACILITIES

The general facilities which have been selected for OWMC's Treatment Facility include the following main features:

- A facility layout which accommodates the receipt, unloading, storage and treatment of Ontario's special waste in a safe, efficient, and reliable manner, while maintaining flexibility to accommodate future expansion of the Facility, if required.

- Safety and security features involving engineered containment systems, fire protection systems and plant security systems which minimize risk to human health and impacts on the environment, and protect Ontario's investment from potential consequences of unauthorized access.

- Waste unloading systems which can safely and efficiently unload and transfer to storage a wide range of wastes expected at OWMC's Facility.

- A tank farm and tank storage facilities for the safe and separate storage of organic and inorganic waste respectively, pending treatment.

- Facilities for the safe and efficient receipt, sampling, storage and processing of organic and inorganic waste delivered to the Facility in drums and miscellaneous containers.

- Laboratory facilities designed for the determination of the characteristics of waste proposed for treatment and to define guidelines for their safe and efficient shipment, receipt, sampling, unloading, storage and treatment. The laboratory will also conduct tests to ensure that the treatment objectives are being achieved.

- A modern data management system for safe efficient planning, coordination and management of the overall operations of the Facility, and process control systems for the control and monitoring of treatment processes and related safety systems.

- Electrical distribution systems and associated lighting, communications and safety systems designed in accordance with pertinent codes and practices, including emergency power supply systems which will ensure the safety of operations during power failure.

- Servicing of the site with raw water, surface water discharge, fuel and electrical power, in a manner which best meets OWMC's goals of minimizing both environmental impact and cost.

- Utility systems consisting of services distributed throughout the site to supply the needs of process areas and ancillary buildings in a safe, reliable, flexible, efficient and cost effective manner, including the environmentally safe management of surface water from the central operating area.

- Vent emission control systems designed to minimize the release of contaminants to the environment due to the release of vent gas and exhaust air from process equipment and process building areas of the Facility.

- Buildings and facilities such as the administration building, gatehouse, and maintenance facilities which are ancillary to, but essential for, the operation of OWMC's Facility.

ENVIRONMENTAL CONSIDERATIONS

The main environmental considerations arising from the conceptual design of the proposed Facility are summarized below:

- Selection of best available proven technology in the design of the incineration plant maximizes the destruction of organic species and minimizes the discharge of residual contaminants to the environment.

- The range of best available proven technologies employed in the design of the physical/chemical treatment plant results in a treated effluent of high quality. This enables the treated effluent to be reused on-site thereby minimizing the total quantity of effluent requiring evaporation.

- OWMC's Facility contains many features designed to minimize the release of fugitive emissions to atmosphere.

- The surface drainage system ensures that no water which could be contaminated is discharged from the Facility before being tested to ascertain that it is safe to do so.

- The fire protection systems minimize the consequences of fire including property loss and temporary loss of treatment capability.

- The on-site monitoring program includes:
  - Tracking of special wastes from initial contacts with a waste generator, through laboratory testing, delivery, unloading, storage, treatment and disposal.
  - Performance and process monitoring to confirm that treatment processes are proceeding as expected, and to ensure that treatment achieves OWMC's goals.

It should be noted that work is presently being conducted by other OWMC consultants to address compliance of facility emissions with Ontario regulations and to determine health risks resulting from such emissions. This work is ongoing and being undertaken by Ontario Research Foundation and Environ Corporation respectively, and will be available prior to the formal environmental assessment submission.

FACILITY CHARACTERISTICS INFORMATION

Facility characteristics information characterizes the Facility from commencement of construction, through start-up and operation of the 150 000 t/a Facility. Additional information was provided for the 300 000 t/a capacity Facility where required for sensitivity analysis of environmental impacts.

This information, which is contained in Chapter 5 and in the Appendices, has been used as a basis of work by other consultants determining environmental impacts.

PROJECT EXECUTION

PROJECT PLANNING AND MANAGEMENT

Monenco Limited, as OWMC's engineering consultant will execute this project using an organization shown on Figure 6.1 (p. 308). It is headed by a

Project Manager who is directly responsible to OWMC's Project Manager for the engineering, procurement and construction management of OWMC's Treatment Facility.

In the engineering design, input (including quality assurance) will also be provided by OWMC's consultants and Monenco Limited's sub-consultants having specialized knowledge and experience in the design and operation of similar facilities in Europe.

SCHEDULE

The proposed schedule covering design, procurement and construction is of 36 months duration with site construction commencing in month 18.

COSTS

Capital and operating cost estimates will be documented in the final Facility Description report.

CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THE REPORT

The purpose of this report is to document the technical features of Ontario Waste Management Corporation's (OWMC) proposed Facility for the treatment of liquid industrial and hazardous waste (special waste). This report is an integral part of OWMC's environmental assessment submission.

This Facility will include a rotary kiln incineration plant for the treatment of organic wastes, a physical/chemical treatment plant for the treatment of inorganic wastes, a solidification plant to further treat the treatment residues and an engineered landfill for the safe disposal of solidified residues. Separate Process Area Reports (Ref: Monenco Limited[9,10,11,12,13]) deal with the selection and optimization of technologies proposed in the areas of incineration, physical/chemical treatment, solidification and engineered landfill, and in the remaining parts of the Facility referred to as general facilities.

This report was prepared for OWMC by Monenco Limited who, as OWMC's engineering consultants, are responsible for the preliminary engineering of the overall Facility.

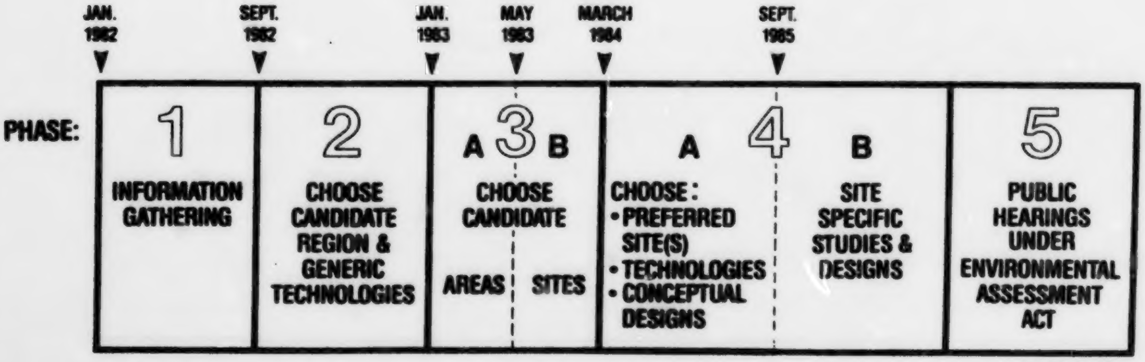
1.2 BACKGROUND INFORMATION

The Ontario Waste Management Corporation (OWMC) is a provincial crown agency formally created in July, 1981 by the Ontario Legislature. OWMC has, as its mandate, the implementation of a province-wide program for the management of liquid industrial waste and hazardous waste (special waste) (Ref: OWMC[1]). This program will include building and managing facilities for the treatment and disposal of special wastes and developing programs to assist in the reduction and recycling of these wastes (Ref: OWMC[1]). It has no responsibility for managing municipal solid waste or radioactive waste, nor is it a regulator of other industrial waste management systems (Ref: OWMC[3]).

In 1982, as part of its prime responsibility to establish and operate a special waste treatment and disposal system, OWMC designed a five-phase Facilities Development Process (Ref: OWMC[4]) to move OWMC through the process of selecting the site and designing the Facilities in preparation for the hearings and approval process required prior to construction. (see Figure 1.1).

FIGURE 1.1

FACILITIES DEVELOPMENT PROCESS


JAN. 1982
SEPT. 1982
JAN. 1983
MAY 1983
MARCH 1984
SEPT. 1985
PHASE:
1
INFORMATION GATHERING
2
CHOOSE CANDIDATE REGION & GENERIC TECHNOLOGIES
A 3 B
CHOOSE CANDIDATE
AREAS
SITES
A 4 B
CHOOSE:
• PREFERRED SITE(S)
• TECHNOLOGIES
• CONCEPTUAL DESIGNS
SITE SPECIFIC STUDIES & DESIGNS
5
PUBLIC HEARINGS UNDER ENVIRONMENTAL ASSESSMENT ACT

OWMC, 1985.

Phase 1 which was completed in September, 1982 (Ref: OWMC[1]):

- defined the nature and size of the industrial waste problem in Ontario,
- described possible treatment technologies,
- described the hydrogeologic conditions throughout Southern Ontario, and
- outlined the engineering, planning and environmental issues that should be considered in later phases.

Phase 2 which was completed in January, 1983 (Ref: OWMC[2]):

- resulted in the search for sites being narrowed to the Golden Horseshoe region of Southern Ontario, and
- selected the initial treatment and disposal facilities comprising:
  - high temperature thermal destruction,
  - physical/chemical treatment processes including solidification, and
  - engineered landfill.

Phase 3 which was completed in March, 1984 (Ref: OWMC[3]):

- identified 20 candidate areas within the Golden Horseshoe,
- identified 152 potential site areas within the 20 candidate areas,
- selected 16 potential sites, and
- reduced the 16 potential sites to a short list of 8 candidate sites.

Phase 4A which was completed in September, 1985 (Ref: OWMC[4]):

- selected the preferred site, designated LF-9C, located in the Township of West Lincoln in the Regional Municipality of Niagara, and

- confirmed the treatment and disposal technologies selected by OWMC for site selection purposes, comprising:
  - a rotary kiln incineration plant,
  - a physical/chemical treatment plant including solidification, and
  - an engineered landfill.

Phase 4B involves the selection and optimization of the preferred technologies for the treatment and disposal of special wastes as well as site specific studies and designs for the establishment and operation of OWMC's Treatment Facility at the LF-9C site.

Phase 5, the final phase of the Facilities Development Process, will be the submission of detailed proposals on the location and design of the Facility, for public hearings under the Environmental Assessment Act of Ontario.

1.3 SCOPE OF WORK

This report documents the following:

- Philosophies established for the design and operation of OWMC's Treatment Facility.

- Description of the proposed conceptual design and operation of the Facility.

- Environmental considerations associated with the design and operation of the Facility.

- Characteristics of the Facility which established the technical basis for site assessment.

- An execution plan for the engineering, procurement and construction of the Facility including scheduling and cost estimates.

The conceptual design for the Facility was based on technology selection and optimization described in the Process Area Reports, utilizing expertise from OWMC consultants and Monenco Limited sub-consultants (Ref: Monenco Limited[9,10,11,12,13]).

In addition, three operating scenarios (typical operation, high effluent and high solidified waste scenarios) were developed (p. 20) to take account of expected variations in the waste characteristics for establishing the conceptual design and facility characteristics.

1.4 REPORT FORMAT

Chapter 1 explains how this Facility Description forms a part of the technical submission on the design and operation of OWMC's proposed Treatment Facility. This report is an integral part of OWMC's environmental assessment submission to the Minister of the Environment under the Environmental Assessment Act of Ontario, to establish and operate a special waste treatment and disposal system at the preferred LF-9C site in the Township of West Lincoln, in the Regional Municipality of Niagara.

Chapter 2 addresses the design criteria in terms of OWMC's objectives and philosophy, applicable codes and standards and local, provincial and federal regulations which formed the basis for the conceptual design of the Facility.

Chapter 3 describes the Facility that OWMC is presently planning to construct and manage for the safe treatment and disposal of liquid industrial and hazardous waste in Ontario. It outlines the conceptual design of the Facility and the method of operation under both normal and abnormal/upset conditions.

Chapter 4 documents the engineering features that have been incorporated into the conceptual design of the Facility to minimize risk to human health and environmental impacts. It addresses emissions from the Facility as well as the various areas of concern that have been raised during OWMC's five-phase Facilities Development Process in terms of the safe operation of the Facility.

Chapter 5 documents the facility characteristics information established as engineering input for use by other consultants in their environmental impact assessment. The results of the environmental impact and risk assessment associated with these facility characteristics will be documented in other consultants' reports.

Chapter 6 details the execution, planning and management associated with OWMC's proposed Treatment Facility, including engineering, procurement, construction, quality assurance, schedule and cost estimates necessary to complete this project.

CHAPTER 2
DESIGN BASIS

2.1 INTRODUCTION

This chapter describes the criteria which were used in the conceptual design of the Facility. These criteria established the basis for the design of various components of the Facility and are based on the following:

- OWMC objectives,
- OWMC philosophy,
- waste profile,
- treatment philosophy,
- premises established by OWMC,
- postulates developed by Monenco Limited, and
- design requirements.

2.2 OWMC OBJECTIVES

As a provincial Crown agency, OWMC has, as its mandate, the implementation of a province-wide program for the management of liquid industrial waste and hazardous waste (Ref: OWMC[1]). OWMC's primary responsibility is to establish and operate a liquid industrial waste and hazardous waste (special waste) management system in Ontario (Ref: OWMC[3]). It has no responsibility for managing municipal solid waste or radioactive waste, nor is it a regulator of other industrial waste management systems (Ref: OWMC[3]).

It is the Corporation's goals to:

- minimize risk to human health,
- minimize environmental impacts, and
- minimize financial costs to OWMC and the people of Ontario.

2.3 OWMC PHILOSOPHY

For the purpose of the five-phase Facilities Development Process, OWMC defined the environment in accordance with the broad and inclusive definition used in the Ontario Environmental Assessment Act (1975) (Ref: OWMC[4]).

OWMC outlined certain principles concerning the types of treatment and disposal facilities required:

- OWMC facilities, no matter how large or small they ultimately may be, must be designed to handle all types of special waste identified as requiring treatment. This full service responsibility is inherent in the concept of OWMC as a Crown agency (Ref: OWMC[3]).

- Special waste must undergo treatment to the fullest possible extent using the world's best proven technology, and the remaining residues must receive the most secure containment possible (Ref: OWMC[3]).

- No hazardous waste will be placed untreated in a secure landfill (Ref: OWMC[1]).

- The initial installation should be capable of expansion through designs that leave room for new construction, equipment that allows for modular expansion, and technologies that favor increased capacity through extra shifts, wherever practical, rather than new construction of additional installations (Ref: OWMC[3]).

- To avoid the design of wasteful excess capacity because of the uncertainty inherent in market estimates, the initial capacity of the facilities should be lower than OWMC's estimates of the final quantity that will ultimately come to its facilities (Ref: OWMC[3]).

- Nevertheless, the initial capacity should be large enough to make a significant impact on the problem of special waste in Ontario, particularly the most potentially hazardous waste streams, and to allow all treatment components to operate efficiently (Ref: OWMC[3]).

Based on these principles and on an engineering study conducted by OWMC's consultants, OWMC has determined (Ref: OWMC[4]) that the initial treatment and disposal facility should consist of:

- a rotary kiln incineration plant,
- a physical/chemical treatment plant (including solidification), and
- an engineered landfill.

Based on the above considerations, and the need to maintain flexibility and adaptability in a potentially changing marketplace, OWMC has concluded that its facilities should be designed with an initial capacity of 150 000 tonnes/year (t/a), with provisions for future expansion up to 300 000 t/a if necessary. The initial capacity of 150 000 t/a would consist of approximately 30 000 tonnes of organic waste and 120 000 tonnes of inorganic waste (Ref: OWMC[4]).

2.4 WASTE PROFILE

To aid in their planning for the implementation of a province-wide program for the management of liquid industrial waste and hazardous waste, OWMC commissioned a Waste Quantities Study in Phase 1 of the Facilities Development Process. This study proposed a definition and classification of liquid industrial waste and hazardous waste (special waste), and estimated the types, quantities and sources of industrial waste generated in Ontario in 1981 (Ref: OWMC[1], OWMC[2], OWMC[3] and The Proctor & Redfern Group[5]).

This work and subsequent discussions OWMC staff have had with waste generators, the waste treatment industry, industrial associations, and federal and municipal authorities produced several results (Ref: OWMC[3]):

- OWMC defined liquid industrial waste and hazardous waste that it must treat as "special waste" - that is, waste that cannot be dealt with properly by conventional treatment facilities such as municipal sewage treatment plants, municipal incinerators and municipal landfills.

- OWMC adopted the waste classification system developed at the University of California at Davis (UCD) to classify the numerous types of industrial waste requiring special treatment in Ontario. The 79 categories considered to be of concern to OWMC were listed in the appendices to OWMC's Phase 1 and Phase 2 Facility Development Reports (Ref: OWMC[1] and OWMC[2]).

- The study estimated that approximately 1.5 million tonnes of special wastes were produced in Ontario in 1981. Approximately 70% were generated in or near the highly industrial area around Lake Ontario, from Oshawa to Niagara Falls, known as the Golden Horseshoe.

- Of the estimated 1.5 million tonnes of special waste produced in Ontario in 1981, over 50% was estimated to be either treated, disposed of or recycled at on-site facilities and by the private sector in Ontario, or exported. The remainder was discharged under permit to municipal sewer systems or deposited in licensed municipal landfills.

- Significant capacity exists in the private waste treatment sector to treat organic waste (approximately 25% of Ontario's special waste is organic). Specifically, Tricil Limited, near Sarnia, is now equipped to treat and dispose of 140 000 tonnes a year of organic waste.

- In 1982, more than 13 000 tonnes of organic waste were sent to receivers outside Ontario; New York State, Michigan, Quebec and Alberta received most of this material. Some of these jurisdictions are planning to develop additional organic waste treatment facilities.

- Many organic wastes are treated on-site by the generator using biological treatment, carbon adsorption and other technologies, to eliminate the wastes or to reduce effluent levels. It is expected that the trend towards increased in-house treatment of these waste streams will continue.

- The recycling industry is active in Ontario and in adjacent jurisdictions. Recycling is on the increase, particularly with the recovery of solvents, the reclamation of oil from organic waste and the extraction of valuable metals from electroplating waste. More than 285 000 tonnes of waste are recycled each year in Ontario by the recycling industry and waste generators, according to OWMC estimates.

- There are no major off-site facilities in Ontario capable of treating inorganic waste, which constitutes approximately 75% of Ontario's special waste. In 1983, a major solidification plant was opened in Quebec, and it now receives a small quantity of inorganic waste from Ontario.

OWMC continued to study special waste generation in the province to improve and update its understanding of the waste quantities issue. This work resulted in a waste profile being established from a survey of 500 industrial establishments, referred to as the "May 1984 Waste Profile", which formed the basis for Monenco's work during Phase 4A of the site selection process (Ref: Monenco Limited[6]).

In March, 1985, an OWMC-commissioned survey of 500 more Ontario manufacturing establishments was completed to establish a more precise waste quantities data base that would assist OWMC in the planning and marketing of treatment and disposal facilities as well as better management of waste reduction programs (Ref: OWMC[4]).

The information obtained from this survey established the waste profile, referred to as the "November 1984 Waste Profile", and the waste characterization data. Monenco reviewed this information in concert with OWMC to develop the waste quantities and characteristics for an OWMC Treatment Facility having a capacity of 150 000 t/a of special waste comprising 120 000 t/a of inorganic waste and 30 000 t/a of organic waste.

The resulting waste quantities and characteristics, which formed the basis for Monenco's conceptual design (as described in later Chapters), are presented in Appendix A, and summarized in Table 2.1.

TABLE 2.1
CANDIDATE WASTES FOR TREATMENT

OWMC CLASS	DESCRIPTION	TYPICAL TOTAL QUANTITY EXPECTED AT OWMC FACILITY (t/a)	TYPICAL WASTE QUANTITIES ORGANICS TO INCINERATION (t/a)	 INORGANICS TO PHYS/CHEM (t/a)	 INORGANIC RESIDUES TO SOLIDIFICATION (t/a)
1	Organic Waste Sludges and Still Bottoms	11 050	9 580	1 470	0
2	Solvents and Organic Solutions	3 330	3 330	0	0
3	Oil and Grease	880	880	0	0
4	Oil and Water Mixtures	3 530	3 530	0	0
5	Organic and Oily Residues	6 030	3 790	2 240	0
6	Heavy Metal Solutions and Residuals	79 480	0	66 050	13 430(1)
7	Miscellaneous Chemicals and Products	3 100	860	2 240	0
8	Paint and Organic Residuals	5 030	4 750	280	0
9	Aqueous Solutions and Organics	1 790	600	1 190	0
10	Anion Complexes	1 070	0	1 070	0
11	Sludges and Inorganic Residuals	32 030	0	12 660	19 370(1)
12	Pesticide and Herbicide Waste	180	180	0	0
13	PCB Wastes	0	0	0	0
14	Clean Up Residuals	2 470	2 470	0	0
				87 200	32 800
	TOTALS	150 000	30 000	120 000	

Notes:

1. In many instances these are residues resulting from physical/chemical treatment at the waste generator's facility.
2. Residues from the physical/chemical treatment plant which require treatment by incineration, are omitted from the above table. These residues will be accommodated in the nominal capacity of the incineration system.
3. Waste quantities are derived from OWMC Waste Profile Information (November, 1984) and are rounded off to the nearest 10 t/a.

2.5 TREATMENT PHILOSOPHY

The philosophy established for OWMC's Treatment Facility, to satisfy OWMC's principle that "special waste must undergo treatment to the fullest possible extent ...... and the remaining residues must receive the most secure containment possible" (p. 8) in line with OWMC's goals (p. 8), is based on a treatment philosophy described in the following paragraphs.

2.5.1 INCINERATION PLANT

Organic special wastes delivered to the Facility for treatment and disposal will be destroyed by high temperature thermal oxidation in the incineration plant (pp 50, 57-68).

The incineration plant will include provisions for cooling the gaseous products of combustion (flue gases) and for treating the cooled flue gases to remove contaminants, prior to the cleaned gases being discharged to atmosphere via a stack (pp 68-75).

Inorganic residues from the incineration plant will be disposed of as follows:

- Solidified slag from the rotary kiln incinerator will be disposed of in the engineered landfill (p. 160).
- Solid residues from the waste heat recovery boiler (i.e. ash), spray dryer and electrostatic precipitator (i.e. salt/flyash) will be further processed in a dedicated solidification plant (pp 76, 77) and then disposed of in the engineered landfill (p. 160).

In addition, the incineration plant will be capable of destroying:

- Organic contaminants which are recovered from aqueous organic wastes in the physical/chemical treatment plant (pp 115, 116).

- Aqueous organic wastes containing low concentrations of organics directly, should these wastes not be amenable to treatment by physical/chemical processes (p. 36).

- Any organic wastes whether solid or liquid, concentrated or dilute, pumpable or non-pumpable.

- Organic contaminants bound in primarily inorganic residues or effluents coming from the physical/chemical treatment plant.

2.5.2 PHYSICAL/CHEMICAL TREATMENT PLANT

Inorganic special wastes delivered to the Facility for treatment, or produced on site, will be chemically stabilized, detoxified and/or concentrated in the physical/chemical treatment plant (pp 100-120).

The physical/chemical treatment plant will also include provisions for treating:

- Contaminated surface drainage or landfill leachates produced in the central operating area of the Facility or in the engineered landfill (p. 118), if required.

- Aqueous organic wastes delivered to OWMC's Facility for treatment, or produced on site, which contain low concentrations of organic contaminants (p. 114).

Treated effluents from the physical/chemical treatment plant will be reused on site to the maximum extent possible. Excess treated effluent will be discharged from the Facility by evaporation, with the steam being discharged to atmosphere via a stack (p. 113).

Treated effluents which fail to meet the required treatment objective for either re-use or discharge to atmosphere by evaporation may either be:

- retreated in the physical/chemical treatment plant,
- solidified if the residual contaminants are inorganic in nature, or
- incinerated if the residual contaminants are organic in nature.

Residues from the physical/chemical treatment plant will be disposed of as follows:

- Organic contaminants recovered from aqueous organic wastes will be incinerated (pp 115, 116).

- Filter cake containing organic contaminants will be incinerated (p. 54).

- Inorganic residues will be solidified and placed in the engineered landfill (pp 139-159).

2.5.3 SOLIDIFICATION PLANT

The primarily inorganic residues from the physical/chemical treatment plant and the incineration plant will be treated by a solidification process (pp 148-150).

The solidification plant will include provision for treating inorganic dry solids and wet non-pumpable residues from generators and miscellaneous clean-up material which do not require physical/chemical treatment (pp 144-146).

During periods when the polishing treatment stage of the physical/chemical treatment plant is shut-down, when internal effluent recycle demands are low due to incineration plant shut-down or if the treated effluent cannot be disposed of for any reason by evaporation, then the resulting effluents may be solidified.

The solidification processes will produce a material suitable for disposal in the engineered landfill. This material will be both physically and chemically stable, so minimizing the rate that residual contaminants will dissolve in water and leach out due to infiltration of water into the engineered landfill.

2.5.4 ENGINEERED LANDFILL

Slag from the incineration plant and solidified material from the solidification plant will be placed in the engineered landfill.

No hazardous waste will be placed untreated into the engineered landfill.

2.6 PREMISES

Premises are the information provided by OWMC, or by other studies undertaken by the Corporation, which have been taken as points of departure for new work. OWMC's basic planning principles and guidelines presented in Sections 2.2 (p. 7) and 2.3 (p. 8) are premises which apply to the OWMC Treatment Facility as a whole. The following additional premises have also been used as starting points for technology selection and the conceptual design of the Facility.

- The OWMC Treatment Facility will be designed as an integrated Facility, located in the Township of West Lincoln, in the Regional Municipality of Niagara.

- The initial treatment and disposal facilities will consist of:
  - a rotary kiln incineration plant,
  - a physical/chemical treatment plant (including solidification), and
  - an engineered landfill.

- OWMC's Treatment Facility will be designed with an initial capacity of 150 000 t/a, with provisions for future expansion up to 300 000 t/a if necessary. The initial capacity of 150 000 t/a of special waste would consist of approximately 30 000 t/a of organic waste and 120 000 t/a of inorganic waste.

- Build up of special waste quantities in a staged manner to 150 000 t/a in the fifth year of operation and 300 000 t/a in the tenth year of operation as follows:

Year of Operation	Total (t/a)	Inorganic (t/a)	Organic (t/a)
1	50 000	30 000	20 000
2	70 000	50 000	20 000
3	105 000	80 000	25 000
4	130 000	100 000	30 000
5	150 000	120 000	30 000
6	180 000	144 000	36 000
7	210 000	168 000	42 000
8	240 000	192 000	48 000
9	270 000	216 000	54 000
10	300 000	240 000	60 000

- November 1984 waste profile and waste characterization data.

- Variations in the types and quantities of special wastes requiring treatment at OWMC's Treatment Facility may result from:
  - effectiveness of OWMC's 4R program, which is to encourage industry in Ontario to Reduce, Recover, Recycle and Reuse industrial waste,
  - industry's response to market demands and to financial constraints,
  - process and manufacturing changes, and
  - changes in Provincial waste regulations.

- Due to expected variations in the types and quantities of special wastes requiring treatment at OWMC's Treatment Facility, it is necessary that the facility conceptual design incorporate features such as:

  - maximum flexibility,
  - future expansion capability, and
  - reserve storage and treatment capacity.

- No wastes will normally be accepted at the Facility unless they have been previously tested and analysed by OWMC's laboratory to determine their physical and chemical characteristics, to identify the treatment processes required and to establish how and when the wastes will be shipped to the Facility for treatment. This does not preclude exceptional circumstances such as the emergency clean-up of spills or instances where it is safer to store hazardous waste at OWMC's Facility than elsewhere, pending determination of treatment and disposal methods.

- Only proven technologies will be considered for OWMC's Treatment Facility. Technologies will be considered "proven" if they have commercially demonstrated to perform reliably for a period of at least 12 months on a scale and in a manner comparable with that required for the OWMC Facility.

- Procedures which were established by OWMC for the delivery, reception and handling of special waste.

Further premises, which were established as the starting point for the development of the conceptual design, are detailed in the Process Area Reports (Ref: Monenco Limited [9,10,11,12,13]).

2.7 POSTULATES

Postulates are assumptions or hypotheses formulated by Monenco or OWMC's Technology Consultants, which are basic to the approach used to develop the conceptual design of the Facility, and are listed as follows:

- Waste quantities and characteristics (eg. inorganic/organic pumpable liquids, sludges and non-pumpables) developed from waste data provided by OWMC are presented in Appendix A, and summarized in Table 2.1 (p. 13).

- The conceptual design and facility characteristics information were established on the basis of three operating scenarios as follows:

  - Typical Operation, based on the following assumptions:
    - Total solid content of the inorganic special waste is 25.8%.
    - 2300 t of inorganic solid waste requires re-slurrying prior to pretreatment.
    - Leachate generated in the engineered landfill is collected and treated.
    - The reverse osmosis unit is used for treating low total dissolved solid (TDS) effluent from the physical/chemical treatment plant for recycling on-site.
    - Evaporation is used for producing distilled water from high TDS effluent from the physical/chemical treatment plant for recycling on-site and disposing of surplus effluent as steam to atmosphere.

  - High Effluent Scenario, based on the following assumptions:
    - Total solid content of inorganic special waste is 10% resulting in increased surplus effluent from the physical/chemical treatment plant to be disposed of by evaporation as steam to atmosphere.

  - High Solidified Waste Scenario, based on the following assumptions:
    - Total solid content of inorganic special waste is 25.8%
    - 80% of the effluent from the physical/chemical treatment plant, originating from incoming waste, contains calcium at a level such that treating this water by evaporation for recycling on-site is impractical.

- The high calcium effluent is solidified and disposed of in the engineered landfill.

Further postulates, which were established as the basis for the conceptual design, are detailed in the Process Area Reports (Ref: Monenco Limited[9,10,11,12,13]).

2.8 DESIGN REQUIREMENTS

The design and engineering of the Facility was carried out to satisfy the objectives, philosophy and premises established by OWMC to achieve its mandate to build and operate a Treatment Facility, in accordance with the requirements of federal, provincial, municipal regulations and guidelines, and the applicable codes, standards and procedures of the industry. These include but are not limited to:

- Government of Canada, Clean Air Act, S.C. 1970-71-72, c. 47 (as am. by S.C. 1980-81-82, c. 45 and 1983-84, c.40).
  - Ambient Air Quality Objectives Order, No. 1 C.R.C. 1978, c. 403
  - Ambient Air Quality Objectives Order, No. 2 C.R.C. 1978, c. 404
  - Ambient Air Quality Objectives Order, No. 3 SOR/78-74 (as am. by SOR/78-812).

- Ontario Environmental Protection Act, R.S.O. 1980, c. 141 (as am. by S.O. 1981, c. 49 and 1983, c. 52).
  - Air Pollution Control (General) Regulations, R.R.O. 1980, Reg. 308 (as am. by O. Reg. 107/85).
  - Ambient Air Quality Criteria Regulation, R.R.O. 1980, Reg. 296.
  - Guidelines for Environmental Protection Measures at Chemical Storage Facilities (October, 1978).
  - Guidelines for Treatment and Disposal of Liquid Industrial Wastes in Ontario (December, 1978).
  - Guidelines for the Control of Industrial Phosphorus Discharges in Liquid Effluents (October, 1978).

  - Waste Management - PCBs Regulation, O. Reg. 11/82 (as amended by O. Reg. 575/84).
  - Guidelines for the Handling and Disposal of Biomedical Wastes From Health Care Facilities and Laboratories (1986).

- Ontario Water Resources Act, R.S.O. 1980, c. 361 (as amended by S.O. 1981, c. 50 and 1983, c. 51).
  - Water Management - Goals, Objectives, Policies and Implementation Procedures for the Ministry of the Environment (November, 1978).
  - Objectives for the Control of Industrial Waste Discharge in Ontario.

- Ontario Ministry of the Environment.
  - Ontario Drinking Water Objectives (Revised 1983).
  - Blueprint for Waste Management in Ontario (June 1983).

- OHSA - Occupational Health and Safety Act and Regulations for Industrial Establishments. Occupation and Safety Act, Revised Statutes of Ontario, 1980 Chapter 321, Revised Regulation of Ontario, 1988, Regulation 692 and Ontario Regulation 714/82.

- Fire Marshals Act - Ontario Regulation 730/81 (Fire Code) as amended by O. Reg. 251/83.

- Ontario Ministry of Municipal Affairs and Housing
  - The Building Code.

- Relevant Municipal By-Laws
- ACI - American Concrete Institute
- AFBMA - Anti-Friction Bearing Manufacturers Association
- AGMA - American Gear Manufacturers Association
- AISC - American Institute of Steel Construction
- ANSI - American National Standards Institute
- API - American Petroleum Industry

- ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
- ASME - American Society of Mechanical Engineers
- ASTM - American Society for Testing and Materials
- CEMA - Conveyor Equipment Manufacturer's Association
- CGSB - Canadian Government Specification Board
- CIRI - Canadian Industrial Risk Insurance Guidelines
- CSA - Canadian Standards Association
- EEMAC - Electrical and Electronic Manufacturers Association of Canada
- FM - Factory Mutual Standards
- IAO - Insurers Advisory Organization Guidelines
- IEEE - Institute of Electrical and Electronic Engineers
- ISA - Instrument Society of America
- ISO - International Standards Organization
- NEMA - National Electrical Manufacturers Association
- NFPA - National Fire Protection Association
- TEMA - Tubular Exchanger Manufacturers Association
- - Ontario Hydro Electrical Safety Code

CHAPTER 3

FACILITY DESCRIPTION AND OPERATION

3.1 INTRODUCTION

This Chapter details the Facility that OWMC proposes to construct and operate at site LF-9C. It describes the conceptual design of the Facility and how it will operate during both normal and abnormal/upset conditions, from when special wastes are received at the Facility, to disposal of the solidified material (treated waste residues) in the engineered landfill and evaporation of excess treated effluent.

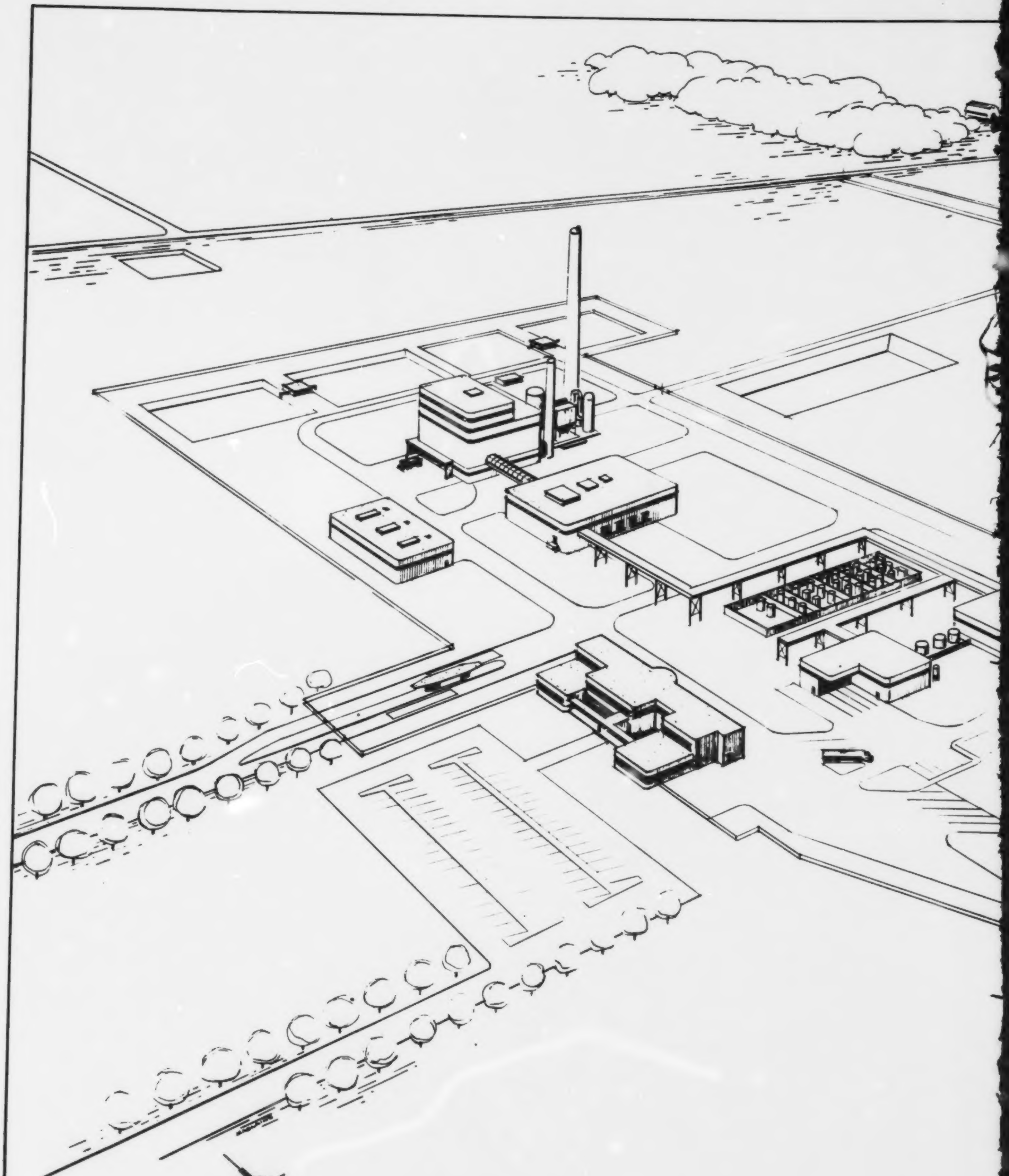
Figure 3.1 is a perspective of the 150 000 t/a Facility.

Figures 3.2 and 3.3 show the conceptual site layout and the central operating area within the overall site, with the remaining area of the site used for landfilling.

Provision is included in the facility layout for expansion to treat 300 000 t/a of special waste, if required at some future time.

Figure 3.4 illustrates the service connections to existing utilities and their routing to the site.

Figure 3.5 presents a pictorial illustration of the overall Facility and shows the flow path of various waste types and forms through the Facility.



N

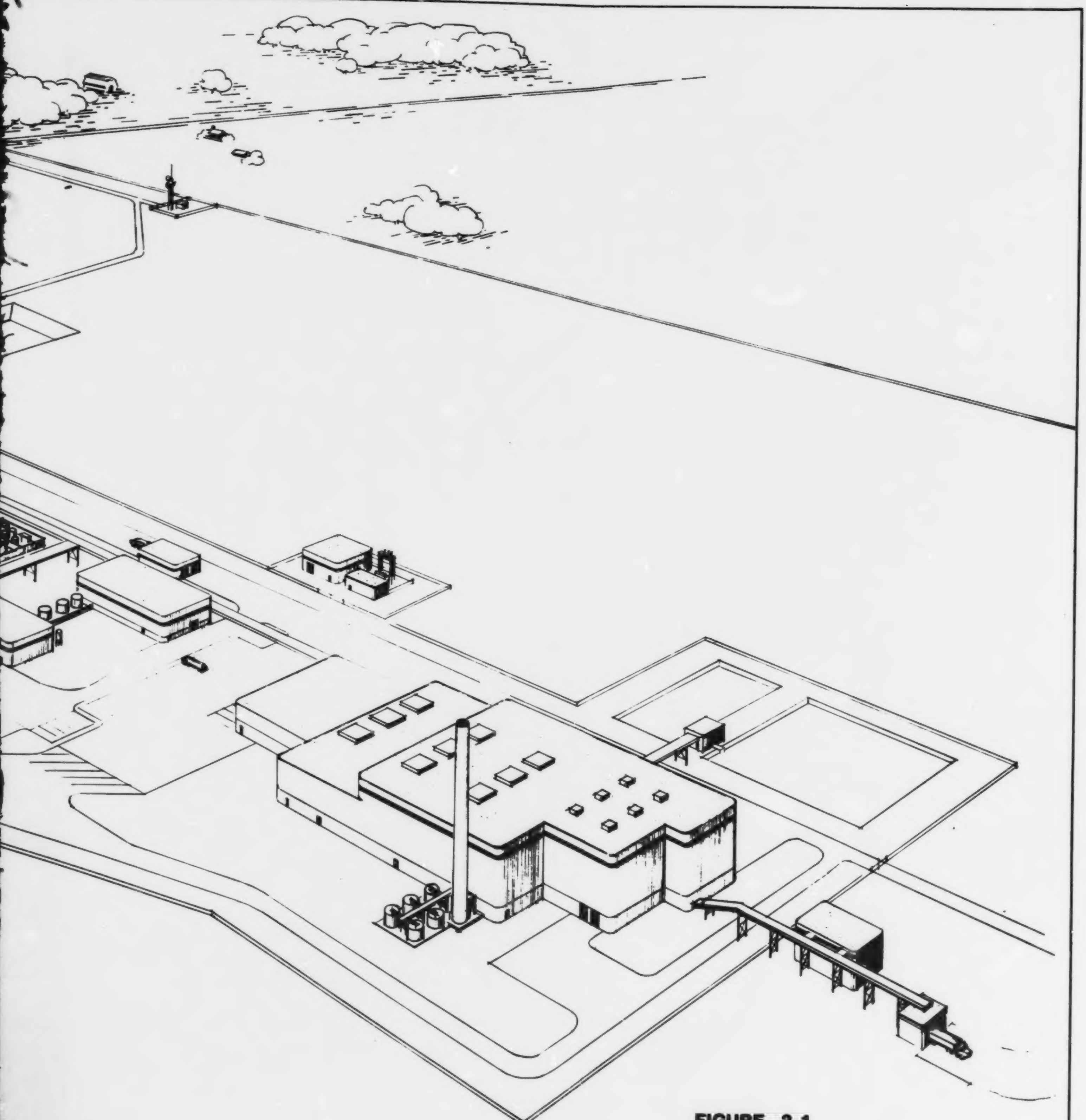
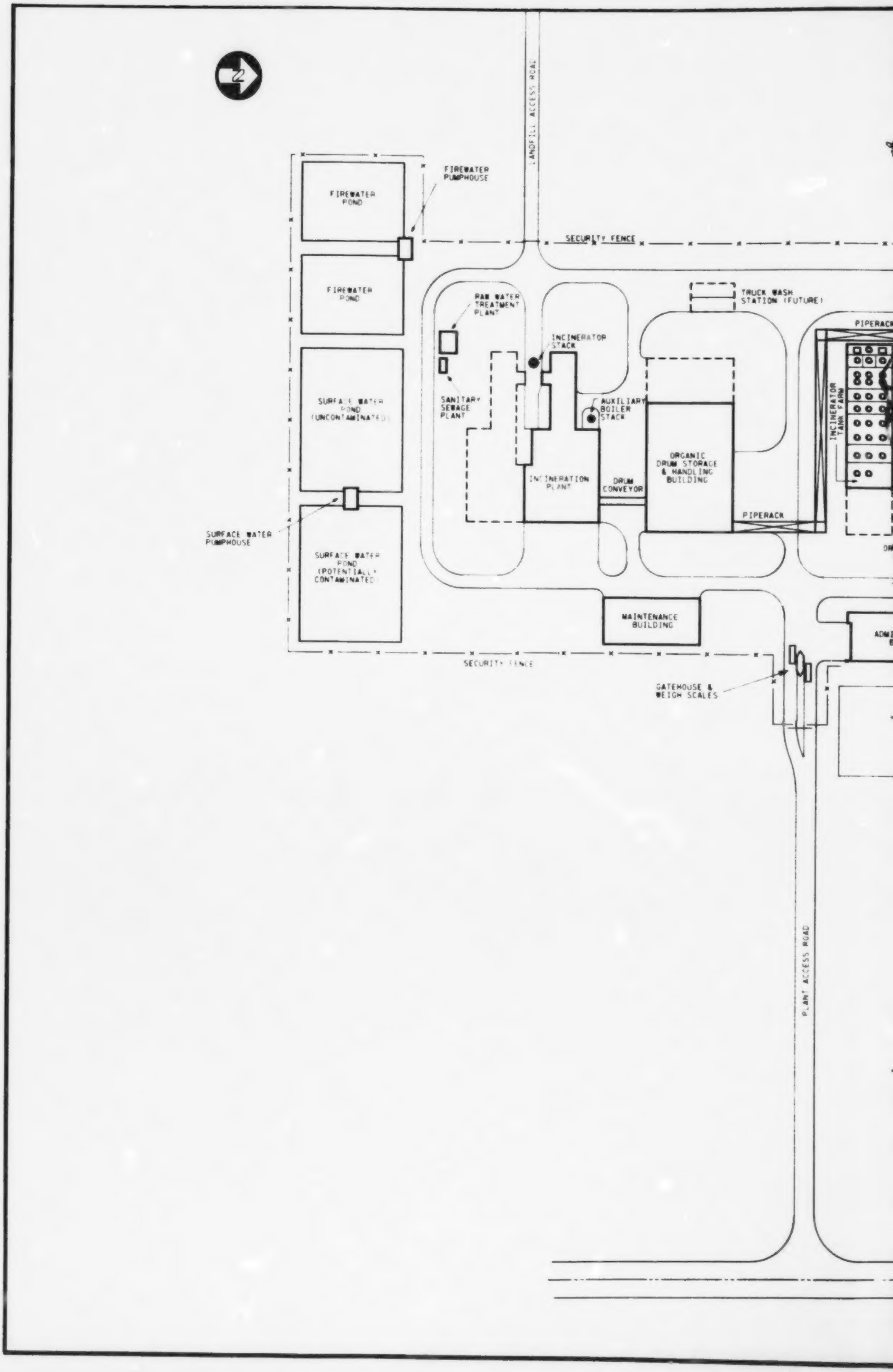


FIGURE 3.1
PERSPECTIVE OF CENTRAL OPERATING AREA


LANDFILL ACCESS ROAD
FIREWATER PUMPHOUSE
FIREWATER POND
SECURITY FENCE
FIREWATER POND
TRUCK WASH STATION (FUTURE)
RAW WATER TREATMENT PLANT
INCINERATOR STACK
PIPERACK
SANITARY SEWAGE PLANT
AUXILIARY BOILER STACK
SURFACE WATER POND (UNCONTAMINATED)
INCINERATOR TANK FARM
ORGANIC DRUM STORAGE & HANDLING BUILDING
INCINERATION PLANT
DRUM CONVEYOR
PIPERACK
SURFACE WATER PUMPHOUSE
SURFACE WATER POND (POTENTIALLY CONTAMINATED)
MAINTENANCE BUILDING
SECURITY FENCE
GATEHOUSE & WEIGH SCALES
PLANT ACCESS ROAD

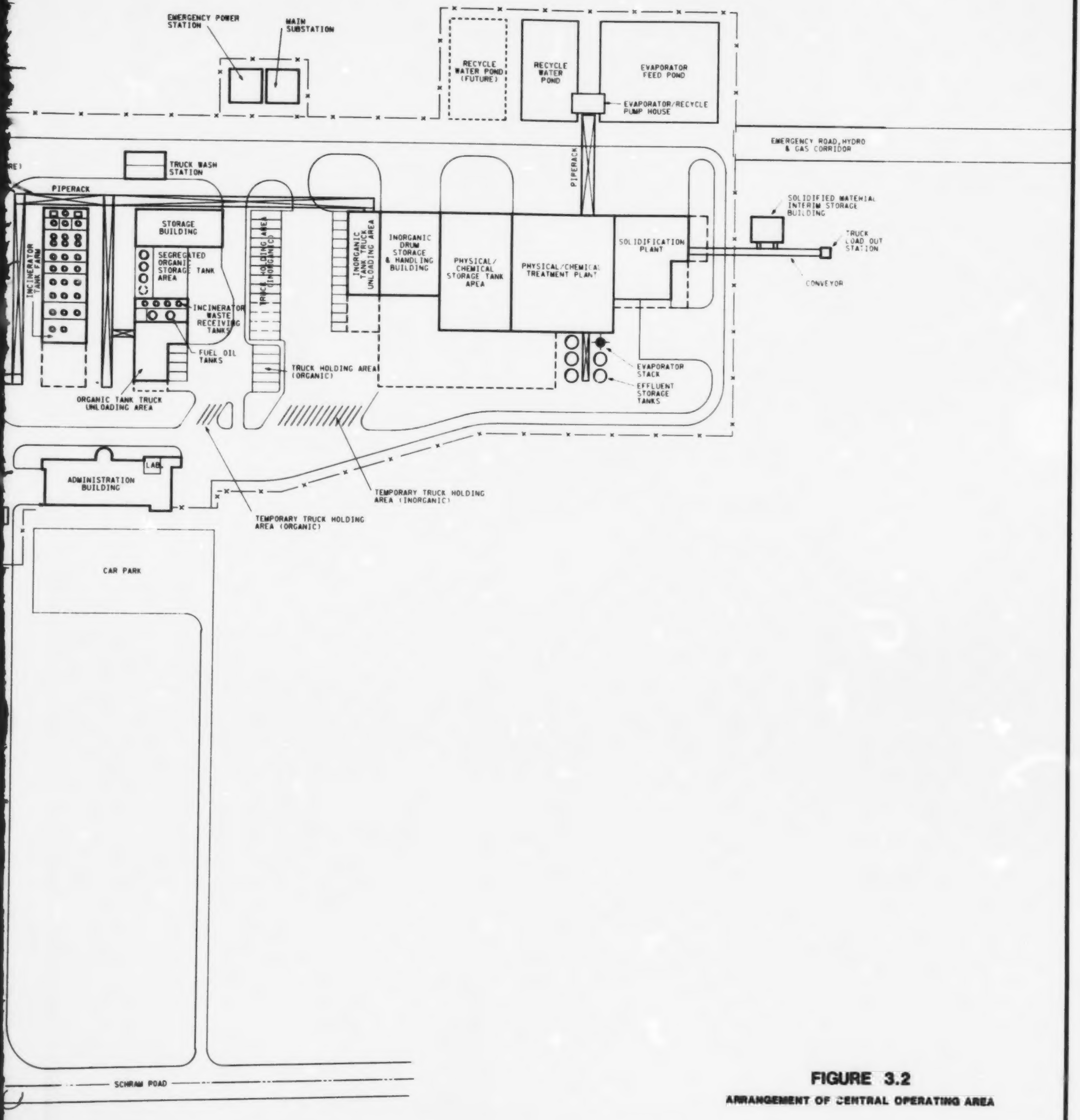
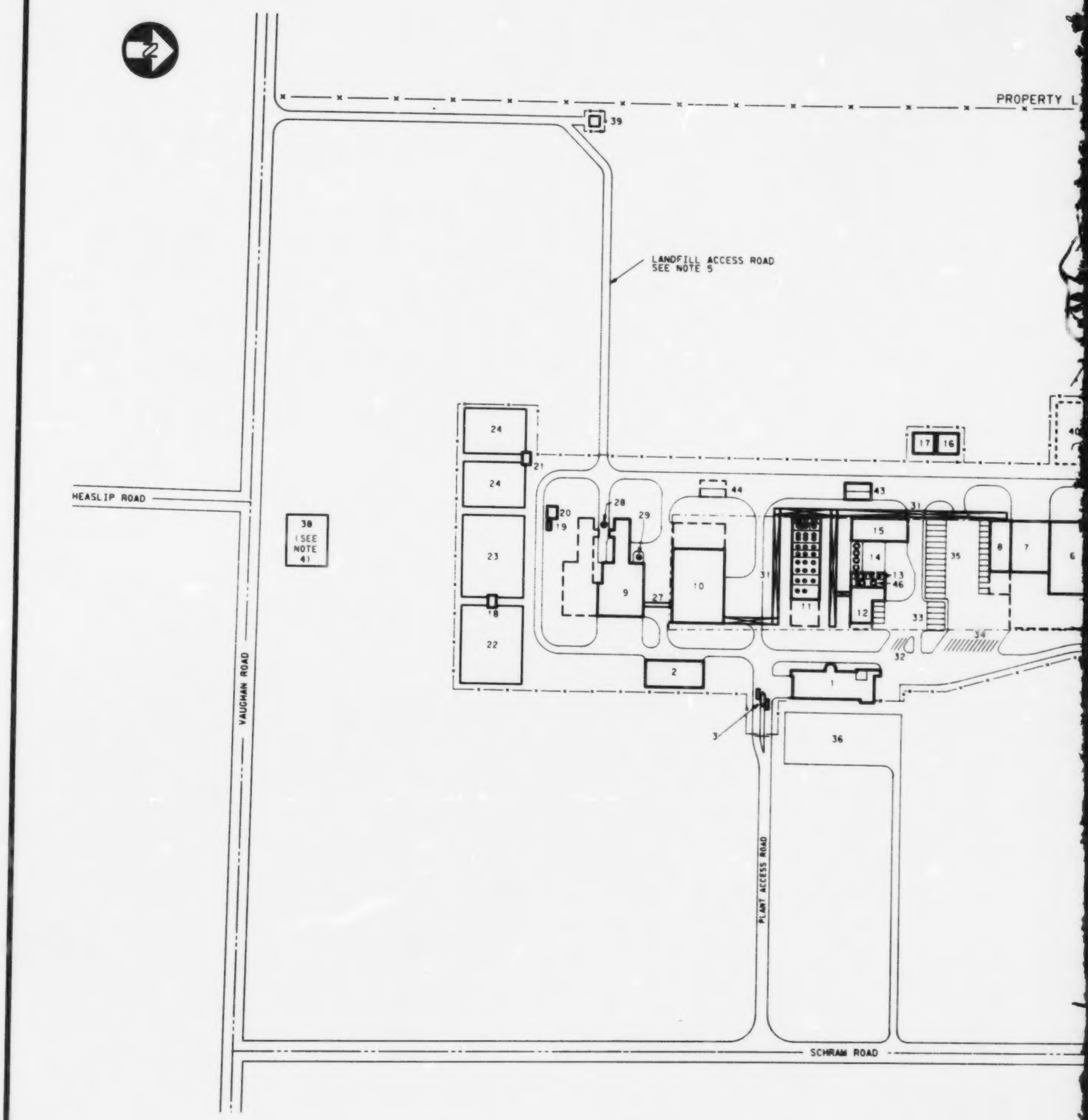
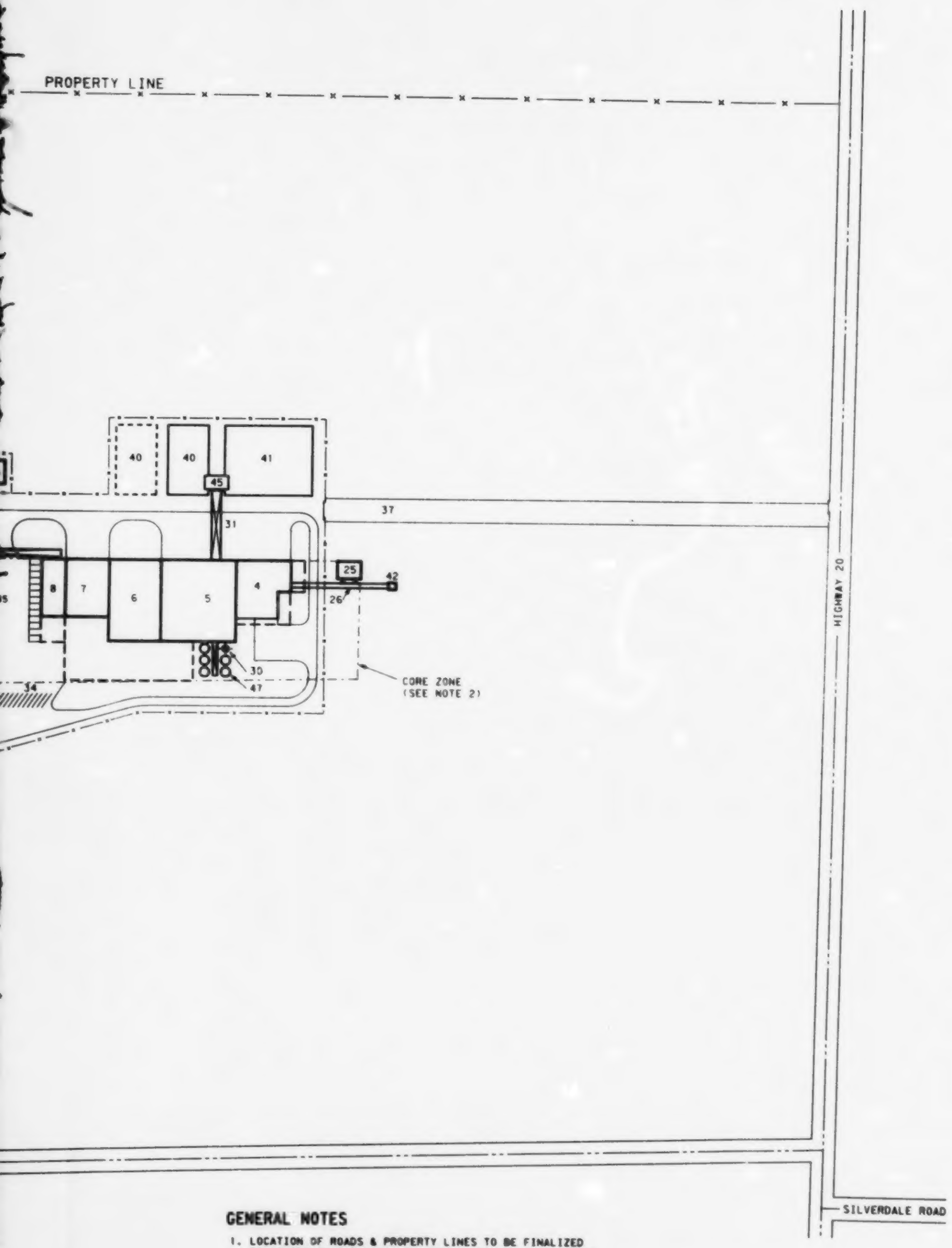

EMERGENCY POWER STATION
MAIN SUBSTATION
RECYCLE WATER POND (FUTURE)
RECYCLE WATER POND
EVAPORATOR FEED POND
EVAPORATOR/RECYCLE PUMP HOUSE
EMERGENCY ROAD, HYDRO & GAS CORRIDOR
PIPERACK
RE)
TRUCK WASH STATION
PIPERACK
SOLIDIFIED MATERIAL INTERIM STORAGE BUILDING
TRUCK LOAD OUT STATION
CONVEYOR
INCINERATOR TANK FARM
STORAGE BUILDING
SEGREGATED ORGANIC STORAGE TANK AREA
INCINERATOR WASTE RECEIVING TANKS
FUEL OIL TANKS
TRUCK HOLDING AREA (INORGANIC)
INORGANIC TANK TRUCK UNLOADING AREA
INORGANIC DRUM STORAGE & HANDLING BUILDING
PHYSICAL/ CHEMICAL STORAGE TANK AREA
PHYSICAL/CHEMICAL TREATMENT PLANT
SOLIDIFICATION PLANT
EVAPORATOR STACK
EFFLUENT STORAGE TANKS
TRUCK HOLDING AREA (ORGANIC)
ORGANIC TANK TRUCK UNLOADING AREA
ADMINISTRATION BUILDING
LAB
TEMPORARY TRUCK HOLDING AREA (INORGANIC)
TEMPORARY TRUCK HOLDING AREA (ORGANIC)
CAR PARK
SCHRAM ROAD

FIGURE 3.2

ARRANGEMENT OF CENTRAL OPERATING AREA


PROPERTY L
39
LANDFILL ACCESS ROAD
SEE NOTE 5
24
24
23
22
21
18
HEASLIP ROAD
38
(SEE NOTE 4)
VAUGHAN ROAD
20
19
28
29
9
27
10
44
43
31
31
17
16
40
15
14
13
46
11
12
33
35
34
32
8
7
6
2
1
3
36
PLANT ACCESS ROAD
SCHRAM ROAD



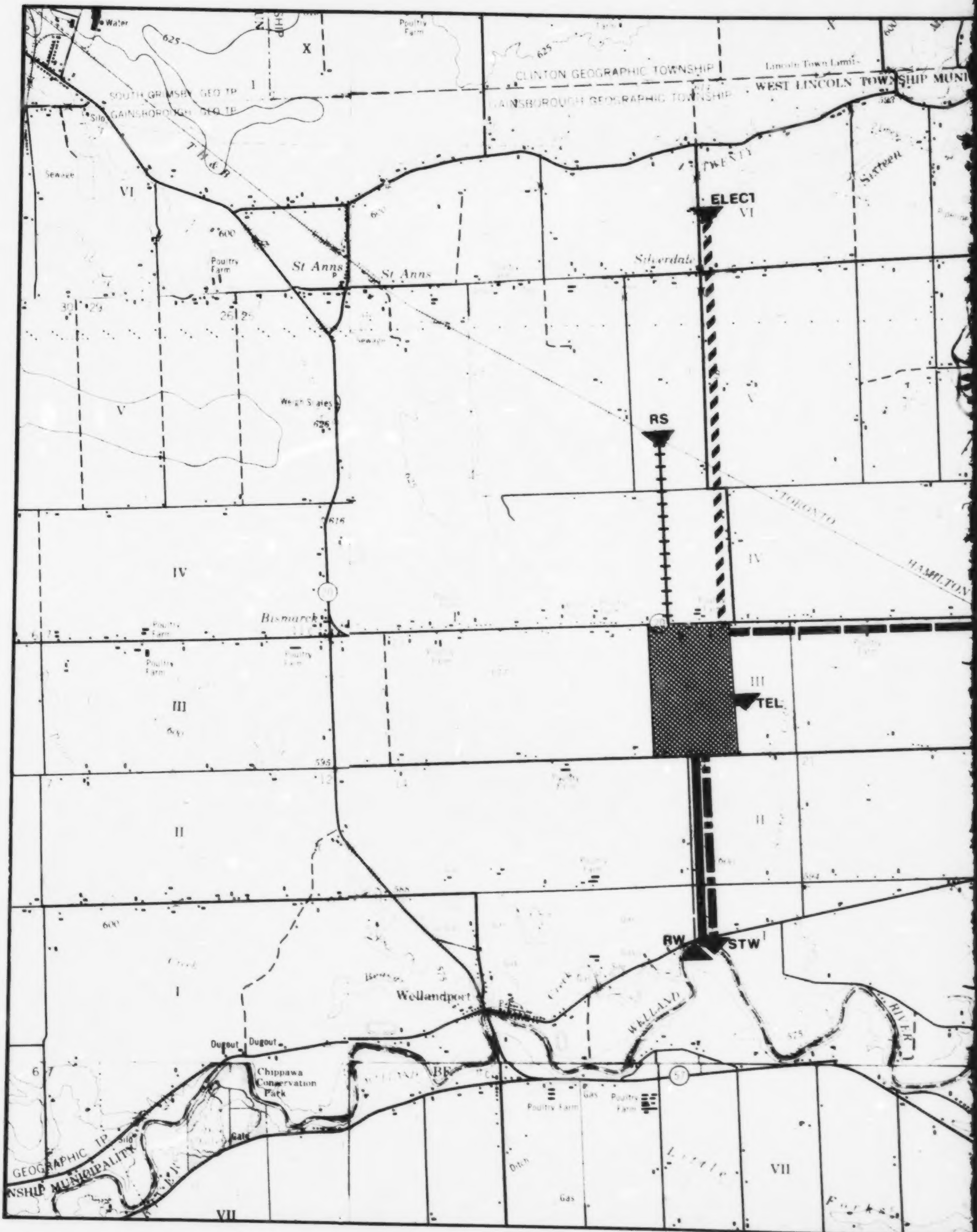
LEGEND

1. ADMINISTRATION BUILDING
2. MAINTENANCE BUILDING
3. GATEHOUSE & WEIGH SCALES
4. SOLIDIFICATION PLANT
5. PHYSICAL/CHEMICAL TREATMENT PLANT
6. PHYSICAL/CHEMICAL STORAGE TANK AREA
7. INORGANIC DRUM STORAGE & HANDLING BUILDING
8. INORGANIC TANK TRUCK UNLOADING AREA
9. INCINERATION PLANT
10. ORGANIC DRUM STORAGE & HANDLING BUILDING
11. INCINERATOR TANK FARM
12. ORGANIC TANK TRUCK UNLOADING AREA
13. INCINERATOR WASTE RECEIVING TANKS
14. SEGREGATED ORGANIC STORAGE TANK AREA
15. STORAGE BUILDING
16. MAIN SUBSTATION
17. EMERGENCY POWER STATION
18. SURFACE WATER PUMPHOUSE
19. SANITARY SEWAGE PLANT
20. RAW WATER TREATMENT PLANT
21. FIREWATER PUMPHOUSE
22. SURFACE WATER POND (POTENTIALLY CONTAMINATED
23. SURFACE WATER POND (UNCONTAMINATED)
24. FIREWATER POND
25. SOLIDIFIED MATERIAL INTERIM STORAGE BUILDING
26. SOLIDIFIED MATERIAL CONVEYOR
27. DRUM CONVEYOR
28. INCINERATOR STACK
29. AUXILIARY BOILER STACK
30. EVAPORATOR STACK
31. PIPERACK
32. TEMPORARY TRUCK HOLDING AREA (ORGANIC)
33. TRUCK HOLDING AREA (ORGANIC)
34. TEMPORARY TRUCK HOLDING AREA (INORGANIC)
35. TRUCK HOLDING AREA (INORGANIC)
36. CAR PARK
37. EMERGENCY ROAD, HYDRO & GAS CORRIDOR
38. LANDFILL STORM DETENTION POND
39. METEOROLOGICAL/AIR MONITORING STATION
40. RECYCLE WATER POND
41. EVAPORATOR FEED POND
42. TRUCK LOAD OUT STATION
43. TRUCK WASH STATION
44. TRUCK WASH STATION (FUTURE)
45. EVAPORATOR/RECYCLE PUMP HOUSE
46. FUEL OIL TANKS
47. EFFLUENT STORAGE TANKS

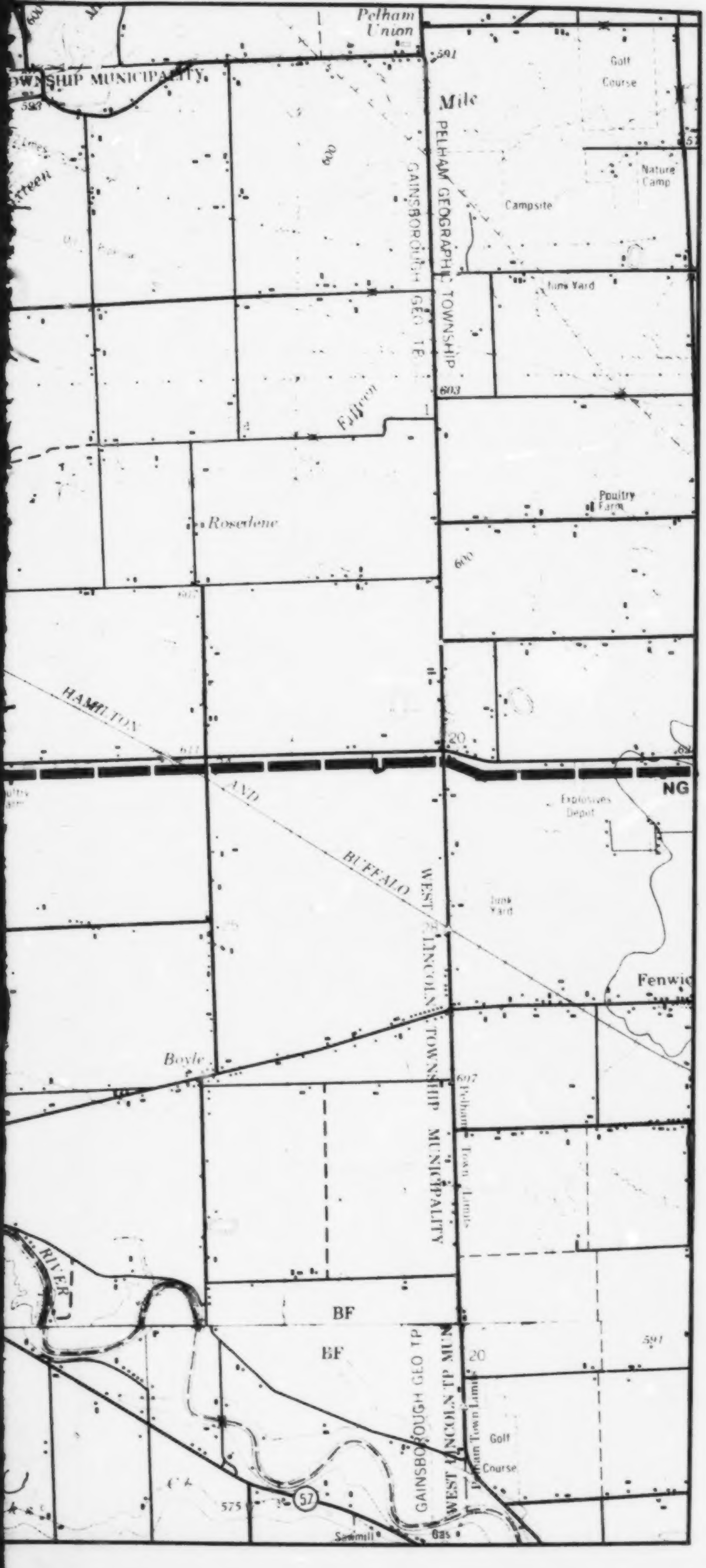
GENERAL NOTES

1. LOCATION OF ROADS & PROPERTY LINES TO BE FINALIZED FOLLOWING CONFIRMATION BY AERIAL AND/OR LEGAL SURVEY
2. CORE ZONE IS DEFINED AS AN ENVELOPE 400M FROM THE SITE BOUNDARIES, AS ESTABLISHED BY OWMC
3. RAIL CORRIDOR NOT SHOWN
4. SIZE & LOCATION OF LANDFILL STORM DETENTION POND TO BE CONFIRMED
5. EXACT LOCATION OF LANDFILL ACCESS ROAD TO BE DETERMINED

FIGURE 3.3
SITE PLAN



Water
625
Poultry Farm
X
I
CLINTON GEOGRAPHIC TOWNSHIP
Lincoln Town Limits
WEST LINCOLN TOWNSHIP MUNI
SOUTH GRIMSBY GEO TP
GAINSBOROUGH GEO TP
GAINSBOROUGH GEOGRAPHIC TOWNSHIP
Silo
TH & B
Sewage
VI
TWENTY
Sixteen
ELECT
VI
600
Poultry Farm
St Anns
St Anns
Silverdale
30
29
26
25
Sewage
Weigh Scales
625
V
V
RS
TORONTO
HAMILTON
616
IV
IV
20
Bismarck
Poultry Farm
Poultry Farm
Poultry Farm
III
III
TEL
595
12
13
II
II
600
Creek
I
RW
STW
Wellandport
WELLAND
RIVER
625
Dugout
Dugout
Chippawa Conservation Park
57
Poultry Farm
Gas
Poultry Farm
Gate
Silo
GEOGRAPHIC TP
NSHIP MUNICIPALITY
Ditch
Gas
Little
Forks
VII
VII


Pelham Union
TOWNSHIP MUNICIPALITY
591
Golf Course
Mile
Nature Camp
600
PELHAM GEOGRAPHIC TOWNSHIP
GAINSBOROUGH GEO TP
Campsite
Junk Yard
603
Fifteen
Poultry Farm
Rosedene
600
HAMILTON
AND
BUFFALO
20
NG
Explosives Depot
Junk Yard
WEST LINCOLN TOWNSHIP MUNICIPALITY
Fenwic
Boyle
607
Pelham Town Limits
RIVER
BF
BF
591
20
GAINSBOROUGH GEO TP
WEST LINCOLN TP MUN
Pelham Town Limits
Golf Course
575
57
Sawmill
Gas

OWMC Ontario Waste Management Corporation

Consultant Monenco

Legend:

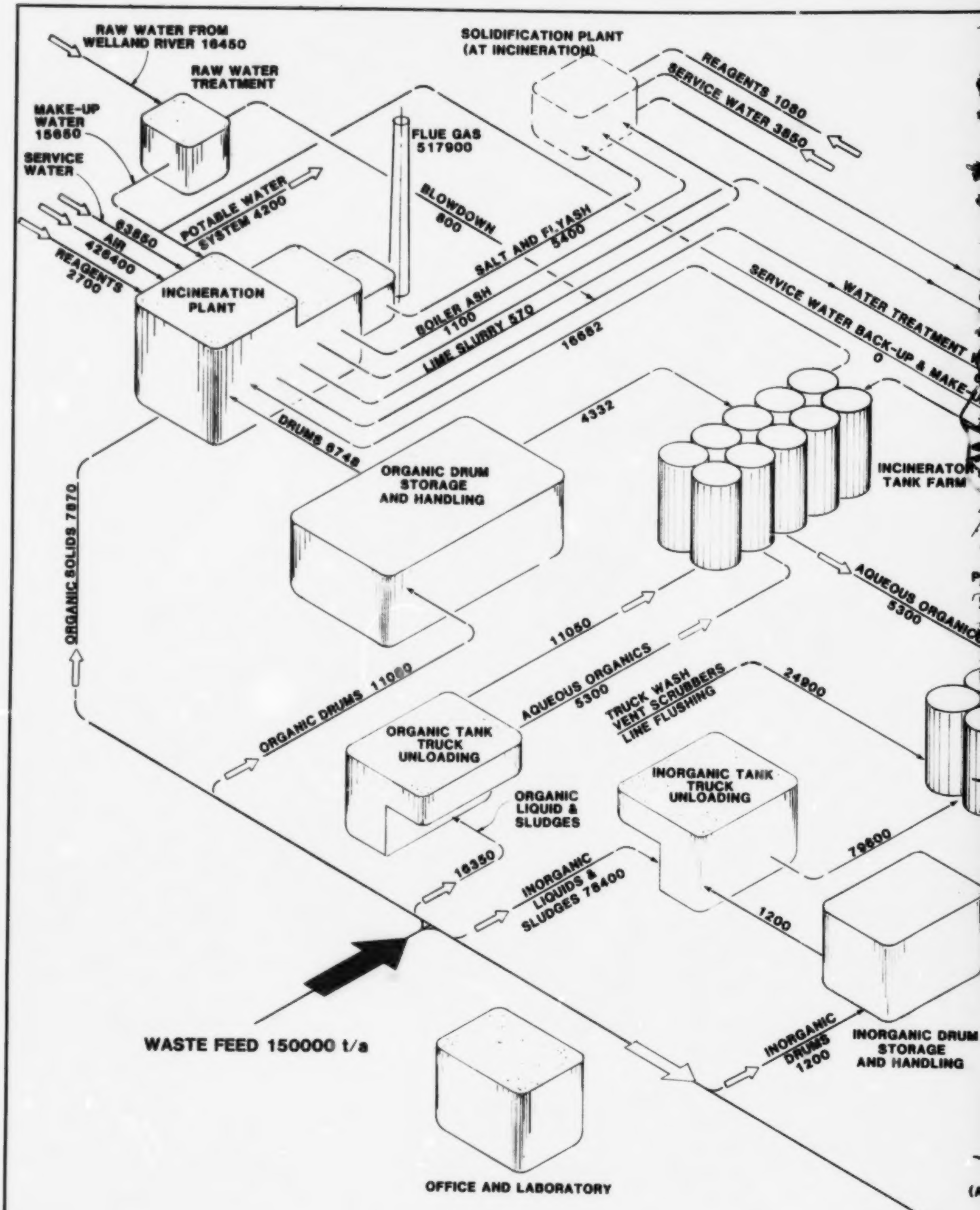
SYMBOL	ABBREVIATION	DESCRIPTION
━━ ▪ ━━ ▪	STW	Clean Stormwater
━━━━━	RW	Raw Water Supply
▴▴▴▴▴▴▴▴	ELECT	Electric Power Supply
	TEL	Telephone
━ ━ ━	NG	Natural Gas Supply
┼┼┼┼┼┼┼┼	PS	Rail Spur
▼		Service Tie-in
▨		Candidate Site

0 1 mile
0 1 Kilometre
1:50 000

SERVICE CONNECTIONS

November 1986

FIGURE 3.4


RAW WATER FROM WELLAND RIVER 16450
RAW WATER TREATMENT
MAKE-UP WATER 15650
SERVICE WATER
63850
AIR 426400
REAGENTS 2700
POTABLE WATER SYSTEM 4200
SOLIDIFICATION PLANT (AT INCINERATION)
REAGENTS 1080
SERVICE WATER 3850
FLUE GAS 517900
BLOWDOWN 800
SALT AND FLYASH 5400
BOILER ASH 1100
LIME SLURRY 570
16682
INCINERATION PLANT
WATER TREATMENT
SERVICE WATER BACK-UP & MAKE-
0
DRUMS 6748
4332
ORGANIC DRUM STORAGE AND HANDLING
INCINERATOR TANK FARM
ORGANIC SOLIDS 7870
AQUEOUS ORGANICS 5300
11050
AQUEOUS ORGANICS 5300
ORGANIC DRUMS 11000
TRUCK WASH VENT SCRUBBERS LINE FLUSHING
24900
ORGANIC TANK TRUCK UNLOADING
INORGANIC TANK TRUCK UNLOADING
ORGANIC LIQUID & SLUDGES
16350
INORGANIC LIQUIDS & SLUDGES 78400
79800
1200
WASTE FEED 150000 t/a
INORGANIC DRUMS 1200
INORGANIC DRUM STORAGE AND HANDLING
OFFICE AND LABORATORY

NOTES:

1) ALL FLOWS ARE IN TONNES/YEAR
2) FLOWS ARE FOR 150000 t/a FACILITY TYPICAL OPERATION
3) CLAY EXPORT WILL INCREASE BEYOND YEAR 5 DUE TO COMPLETION OF BERMS
4) LEACHATE WILL INCREASE WITH LANDFILL AREA

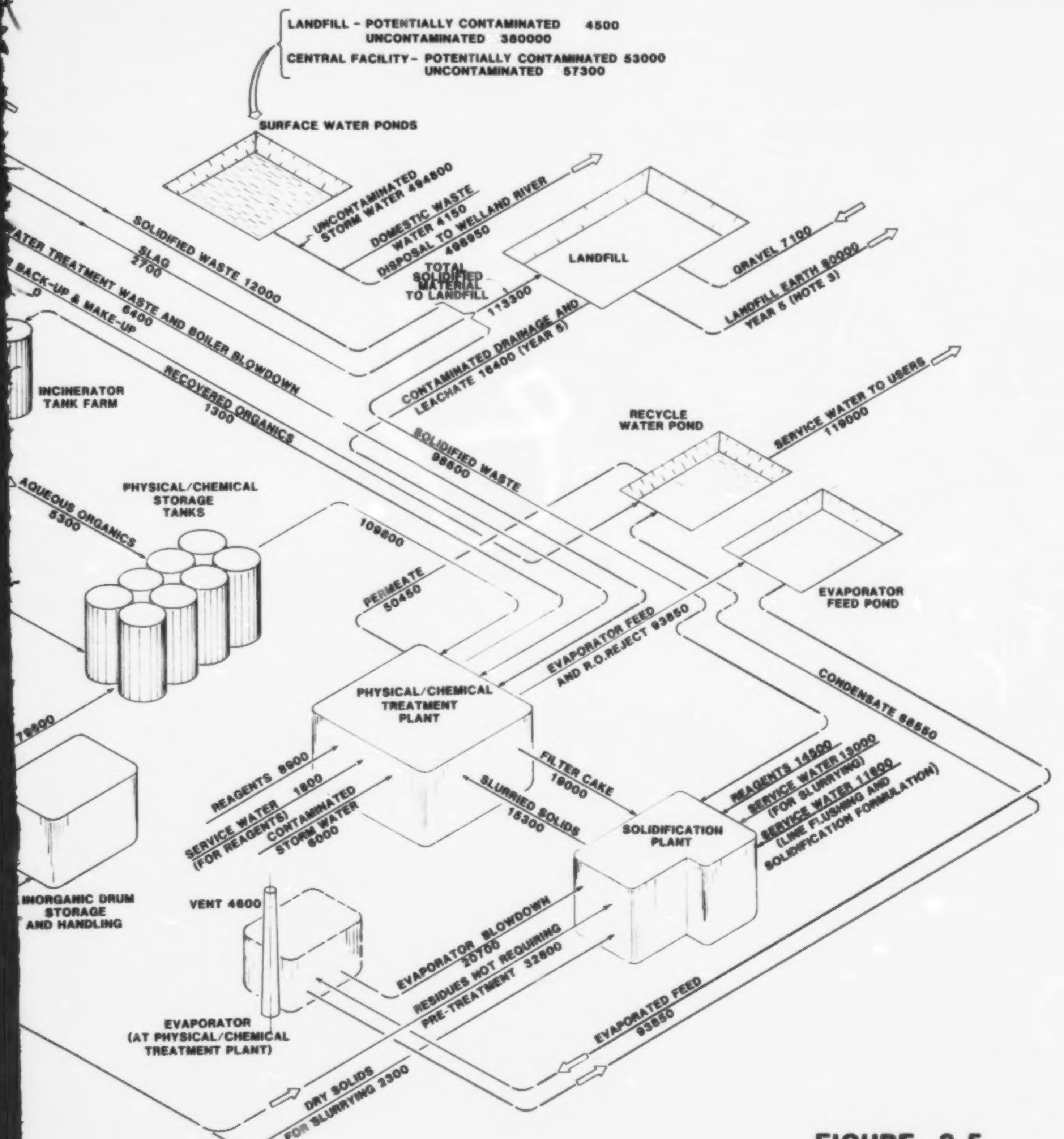

LANDFILL - POTENTIALLY CONTAMINATED 4500
UNCONTAMINATED 380000
CENTRAL FACILITY- POTENTIALLY CONTAMINATED 53000
UNCONTAMINATED 57300
SURFACE WATER PONDS
UNCONTAMINATED STORM WATER 494800
DOMESTIC WASTE WATER 4150
DISPOSAL TO WELLAND RIVER 498950
SOLIDIFIED WASTE 12000
SLAG 2700
TOTAL SOLIDIFIED MATERIAL TO LANDFILL 113300
LANDFILL
GRAVEL 7100
LANDFILL EARTH 80000 YEAR 5 (NOTE 3)
WATER TREATMENT WASTE AND BOILER BLOWDOWN 6400
BACK-UP & MAKE-UP 0
CONTAMINATED DRAINAGE AND LEACHATE 16400 (YEAR 5)
INCINERATOR TANK FARM
RECOVERED ORGANICS 1300
SERVICE WATER TO USERS 119000
RECYCLE WATER POND
SOLIDIFIED WASTE 98600
AQUEOUS ORGANICS 5300
PHYSICAL/CHEMICAL STORAGE TANKS
109800
PERMEATE 50450
EVAPORATOR FEED POND
EVAPORATOR FEED AND R.O.REJECT 93850
PHYSICAL/CHEMICAL TREATMENT PLANT
CONDENSATE 88550
79600
REAGENTS 8900
SERVICE WATER 1800 (FOR REAGENTS)
CONTAMINATED STORM WATER 6000
FILTER CAKE 18000
SLURRIED SOLIDS 15300
REAGENTS 14500
SERVICE WATER 13000 (FOR SLURRYING)
SERVICE WATER 11600 (LINE FLUSHING AND SOLIDIFICATION FORMULATION)
SOLIDIFICATION PLANT
INORGANIC DRUM STORAGE AND HANDLING
VENT 4600
EVAPORATOR BLOWDOWN 20700
RESIDUES NOT REQUIRING PRE-TREATMENT 32800
EVAPORATOR (AT PHYSICAL/CHEMICAL TREATMENT PLANT)
EVAPORATED FEED 93850
DRY SOLIDS FOR SLURRYING 2300
OF BERMS

FIGURE 3.5

PICTORIAL FLOW DIAGRAM
OVERALL FACILITY
TYPICAL OPERATION

3.2 WASTE DELIVERY

Wastes will be accepted at the Facility only after they have been tested and analysed by the main laboratory (p. 244) to verify their physical and chemical characteristics.

Figure 3.6 presents a pictorial flow diagram which illustrates the handling and storage of wastes.

3.2.1 WASTE RECEPTION

A security/traffic control gatehouse complete with communication links and entrance barrier control gates is located at the main entrance. Weigh scales for weighing incoming and outgoing vehicles are also located there.

Wastes will be delivered to the Facility in a variety of ways as follows:

- Bulk pumpable liquids and/or sludges, in road tankers.
- Bulk pumpable liquids and/or sludges containing gross solids, in special road tankers or containers.
- Bulk non-pumpable wastes, in dump trucks, tippable containers or tanker type vehicles.
- Segregated organic wastes (such as PCBs), in custom fabricated containers or in road tankers.
- Custom wastes (such as biomedical waste) in approved containers.
- Wet or dry solids in drums.

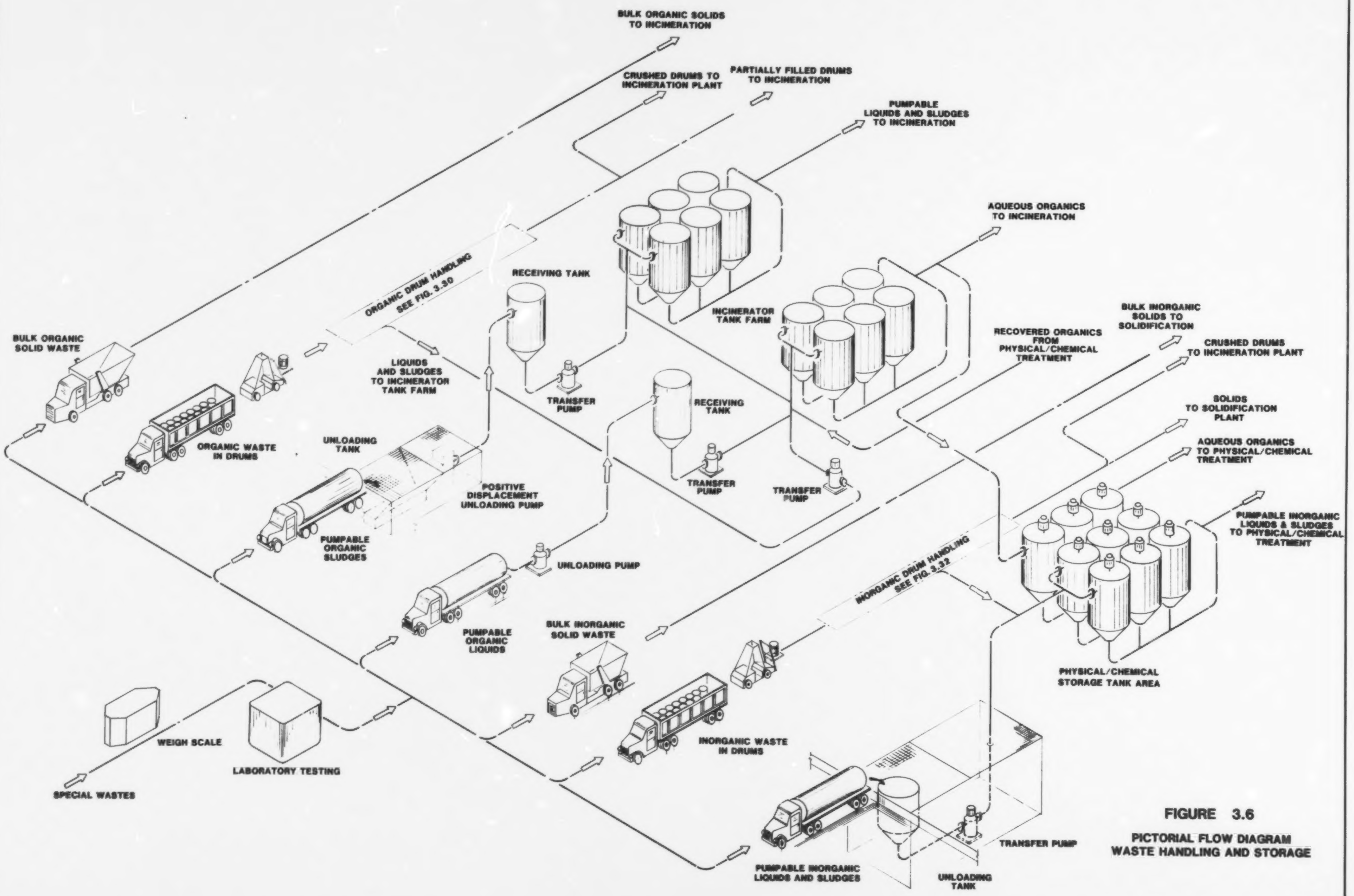

BULK ORGANIC SOLIDS TO INCINERATION
CRUSHED DRUMS TO INCINERATION PLANT
PARTIALLY FILLED DRUMS TO INCINERATION
PUMPABLE LIQUIDS AND SLUDGES TO INCINERATION
AQUEOUS ORGANICS TO INCINERATION
ORGANIC DRUM HANDLING SEE FIG. 3.30
RECEIVING TANK
INCINERATOR TANK FARM
BULK ORGANIC SOLID WASTE
LIQUIDS AND SLUDGES TO INCINERATOR TANK FARM
TRANSFER PUMP
RECEIVING TANK
TRANSFER PUMP
TRANSFER PUMP
RECOVERED ORGANICS FROM PHYSICAL/CHEMICAL TREATMENT
BULK INORGANIC SOLIDS TO SOLIDIFICATION
CRUSHED DRUMS TO INCINERATION PLANT
SOLIDS TO SOLIDIFICATION PLANT
AQUEOUS ORGANICS TO PHYSICAL/CHEMICAL TREATMENT
PUMPABLE INORGANIC LIQUIDS & SLUDGES TO PHYSICAL/CHEMICAL TREATMENT
ORGANIC WASTE IN DRUMS
UNLOADING TANK
POSITIVE DISPLACEMENT UNLOADING PUMP
PUMPABLE ORGANIC SLUDGES
UNLOADING PUMP
INORGANIC DRUM HANDLING SEE FIG. 3.32
PUMPABLE ORGANIC LIQUIDS
BULK INORGANIC SOLID WASTE
PHYSICAL/CHEMICAL STORAGE TANK AREA
WEIGH SCALE
LABORATORY TESTING
INORGANIC WASTE IN DRUMS
SPECIAL WASTES
TRANSFER PUMP
PUMPABLE INORGANIC LIQUIDS AND SLUDGES
UNLOADING TANK

FIGURE 3.6

PICTORIAL FLOW DIAGRAM
WASTE HANDLING AND STORAGE

- Liquids, containing either pumpable or non-pumpable sludges, in drums.

Incoming trucks of waste will be weighed and have their documentation checked at the gate house. Trucks will then be directed to a designated area where personnel from the main laboratory will examine the waste documentation and take samples for "fingerprint" testing as follows:

- bulk wastes on arrival, and
- drums after being unloaded.

Trucks will then be directed to one of the two temporary truck holding areas, depending on whether the waste is organic or inorganic, to await verification of the waste documentation and inspection of drums.

Next, the trucks will be directed to their respective handling area within the Facility as follows:

- Bulk pumpable liquids and/or sludges:
  - organic waste to the truck holding area (organic), and
  - inorganic waste to the truck holding area (inorganic).

- Bulk pumpable liquids and/or sludges containing gross solids:
  - organic special waste to the truck holding area (organic), and
  - inorganic special waste to the truck holding area (inorganic).

- Bulk non-pumpable waste:
  - dry organic waste to the incineration plant,
  - inorganic waste, not requiring treatment in the physical/chemical treatment plant, to the solidification plant, and
  - inorganic waste, requiring treatment in the physical/ chemical treatment plant, either to the solidification plant if size reduction is required or to the truck holding area (inorganic).

- Segregated organic waste (such as PCBs):
  - incineration plant if in custom fabricated containers, and
  - segregated organic storage tank area if in road tankers.

- Custom waste (such as biomedical waste):
  - incineration plant.

- Wet or dry solids in drums:
  - organic waste to the organic drum storage and handling building, and
  - inorganic waste to the inorganic drum storage and handling building.

- Liquids containing either pumpable or non-pumpable sludges in drums:
  - organic waste to the organic drum storage and handling building, and
  - inorganic waste to the inorganic drum storage and handling building.

3.2.2 WASTE HANDLING AND STORAGE

Various waste handling facilities are provided to receive and unload waste shipments and transfer the waste to storage facilities depending on the physical characteristics of the waste and whether the waste is classed as organic or inorganic.

3.2.2.1 Organic Wastes

Organic wastes are unloaded at the following designated areas:

- organic tank truck unloading area,
- incineration plant,
- segregated organic storage tank area, and
- organic drum storage and handling building.

Organic Tank Truck Unloading Area

The organic tank truck unloading area comprises four bulk waste unloading stations and will receive organic waste in the form of bulk pumpable liquids and/or sludges, which may contain gross solids, by road tanker and/or containers. Road vehicles reverse into their designated unloading station ready for unloading under the supervision of OWMC operations personnel.

Liquids/Sludges. Two of the four bulk waste unloading stations are provided with a below grade basin containing a waste unloading tank for receiving bulk pumpable wastes containing sludges, thick sludges and/or gross solids from special road tankers or containers. This type of unloading station is illustrated in Figure 3.7.

Wastes are unloaded by gravity, from the road tanker, using large hoses or chutes, and discharged through a removable basket strainer (to remove gross solids) into 25 m^3 capacity waste unloading tanks located below grade.

Alternatively, waste received in containers is tipped via chutes into below grade waste unloading tanks.

Gross solids retained by the basket strainer are either emptied into drums for transfer to the organic drum storage and handling building (p. 185) or transferred to waste storage pits located at the incineration plant (p. 54).

Waste is transferred from the unloading tank to an intermediate waste receiving tank (of 40 m^3 nominal capacity) using the organic waste unloading pump mounted in the bottom of the below grade unloading tank. This organic waste unloading pump is a positive displacement pump. Alternatively, waste can be pumped directly from the unloading tank to the incinerator tank farm using the unloading pump.

Thick sludges which require dilution prior to being transferred to intermediate waste receiving tanks are also unloaded at this type of

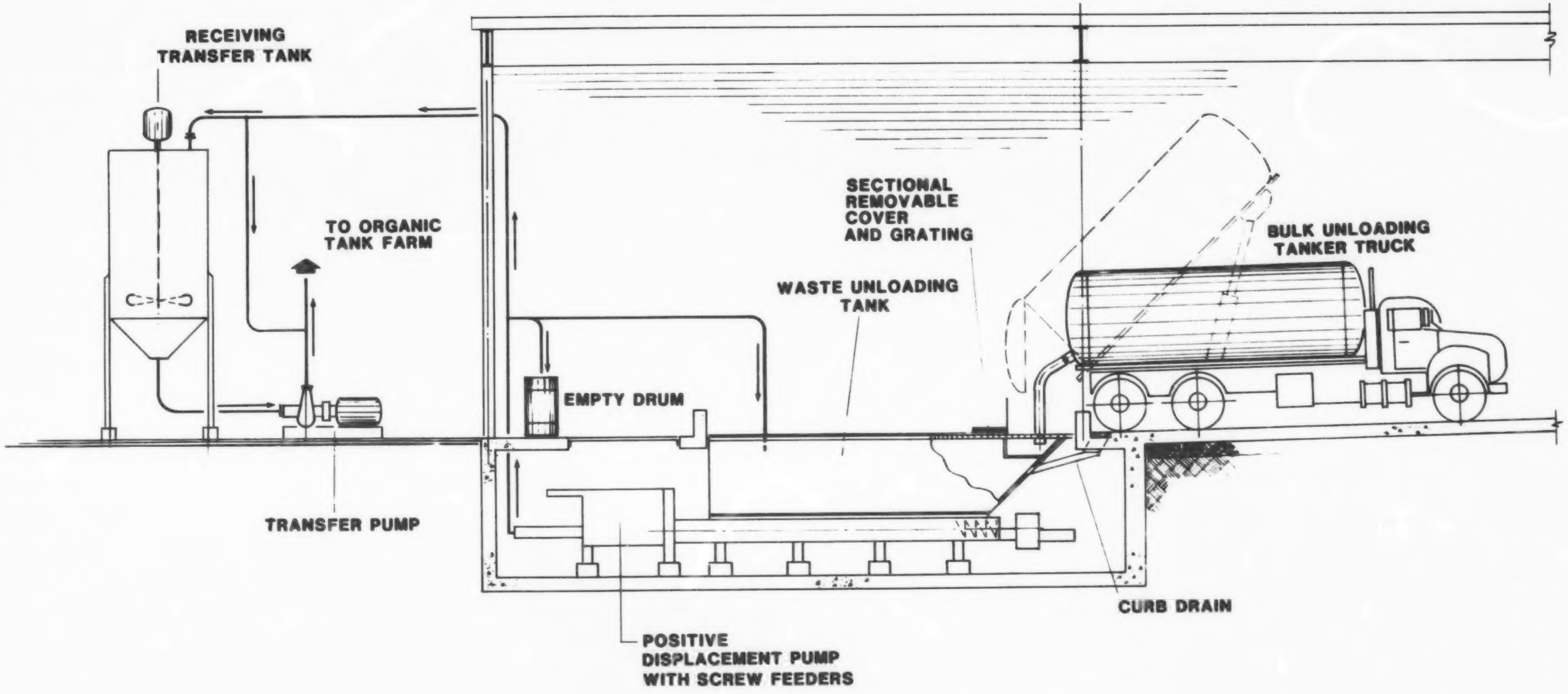

RECEIVING TRANSFER TANK
TO ORGANIC TANK FARM
SECTIONAL REMOVABLE COVER AND GRATING
BULK UNLOADING TANKER TRUCK
WASTE UNLOADING TANK
EMPTY DRUM
TRANSFER PUMP
CURB DRAIN
POSITIVE DISPLACEMENT PUMP WITH SCREW FEEDERS

FIGURE 3.7
ORGANIC UNLOADING STATION
LIQUIDS AND SLUDGES
PICTORIAL SCHEMATIC

station. Thick sludges and dilution medium (oil or water) are placed in the unloading tank and the contents recirculated using the positive displacement pump, prior to being transferred to the intermediate receiving tank. A connection is provided in the recirculation piping to allow thick sludges to be transferred to drums, if it proves impractical to render them readily pumpable by recirculation and liquid addition, and then transferred to the organic drum storage and handling building.

Liquids. The other two stations are each provided with an organic waste unloading pump located at grade for unloading bulk pumpable liquids and sludges directly from the vehicle into an intermediate organic waste receiving tank. Alternatively, the organic waste from the road tanker can be unloaded using the road tanker's own chassis mounted unloading pump. In addition the waste can be pumped from the road tanker directly to the incinerator tank farm using the organic waste unloading pumps.

General. Organic wastes are normally pumped from either type of unloading station to the associated intermediate waste receiving tank. This tank is hopper bottomed to facilitate removal of sediment, fitted with an agitator and provided with a pump to transfer the waste to the storage tanks of the incinerator tank farm. Each tank and associated piping and equipment is heat traced and insulated to prevent possible freeze-ups and to ensure good flow properties. In the event that the receiving tank cannot be immediately emptied for any reason, a bypass line is provided so that subsequent waste shipments can be transferred directly to the incinerator tank farm using the unloading station pump.

Aqueous organic wastes are pumped from the unloading stations either to the aqueous organic tanks in the incinerator tank farm (p. 170) or to the aqueous organic tanks in the physical/chemical storage tank area, (p. 181) depending on processing strategy. The incinerator tank farm receives those shipments designated for incineration or requiring phase separation prior to transfer to the physical/chemical treatment plant for processing.

Each unloading station is equipped with flushing connections to flush out the suction and discharge lines of the pumps. The flushing medium will be water, although, where necessary (e.g. for heavy organic residues or cold weather situations) it will be supplemented by steam. After unloading a vehicle, any sludge or sediment remaining in the cargo hold is flushed, by liquid recirculation if necessary, and pumped out. The unloading hose is then disconnected from the vehicle and allowed to drip drain into the unloading tank. The hose is then flushed out with water/steam and its end capped.

Each of the unloading stations is designed with sloped surfaces and curbs to ensure waste containment in the event of leaks/spills during unloading procedures. Additionally, the contained area of each unloading station, in conjunction with the below grade unloading tank, is sized to contain 40 m^3 in the event of a complete rupture of the maximum sized waste transport vehicle. Unloading stations not equipped with below grade unloading tanks have trench drains connecting to the next adjacent below grade unloading tank. The contained area of each unloading station has a chemical resistant surface.

Double containment, as more fully described in Chapter 4, is employed for the parts of the unloading stations located below ground level. It comprises concrete structures housing unloading tanks, pumps and associated piping systems. Ventilation is incorporated to minimize fugitive emissions. The unloading system located below ground level is monitored by hydrocarbon detectors and checked prior to personnel entry.

The unloading stations have roofs, sidewalls and one endwall. In addition to providing weather protection, the enclosure enhances the operation of the vent system in minimizing fugitive emissions. In this regard, the openings to the below grade unloading tanks are fitted with gates which are normally closed to minimize emissions. These tanks are connected to an exhaust system which draws air into the unloading tank and thereby minimizes vapour emissions when the gates are opened, as well as maintaining a negative pressure within the unloading tank when the gates are closed. The gates are only opened when waste discharge by gravity dumping is required. Waste discharge by hose is through an auxiliary opening.

All intermediate waste receiving tanks are nitrogen gas blanketted to protect against explosion and fire, as described in Section 3.7.9.1 (p. 238).

Incineration Plant

Provision has been made at the incineration plant to receive the following wastes:

- dry organic wastes,
- segregated organic wastes (such as PCBs), and
- custom wastes.

Dry Organic Waste. Low volatile dry solid waste such as contaminated soil or packaging material delivered to the Facility in dump trucks or tippable containers will be off-loaded and stored in enclosed pits located in the incinerator feed building (p. 54).

Segregated Organic Wastes. Segregated organic wastes (such as PCBs, pesticides, herbicides etc.) delivered in custom fabricated containers by truck will be off-loaded at the incineration plant.

Custom Wastes. Custom wastes (such as biomedical wastes or old bank notes etc.) will be unloaded and conveyed directly to the incinerator (p. 56).

Segregated Organic Storage Tank Area

Road tankers delivering so-called segregated organic wastes (such as PCBs) will be unloaded into dedicated segregated organic waste storage tanks (p. 174).

Organic Drum Storage and Handling Building

Trucks delivering organic waste in drums will be directed to the organic drum storage and handling building where the drums will be unloaded by fork lift truck (p. 185).

3.2.2.2 Inorganic Wastes

Inorganic wastes are unloaded at the following designated areas:

- inorganic tank truck unloading area,
- solidification plant, and
- inorganic drum storage and handling building.

Inorganic Tank Truck Unloading Area

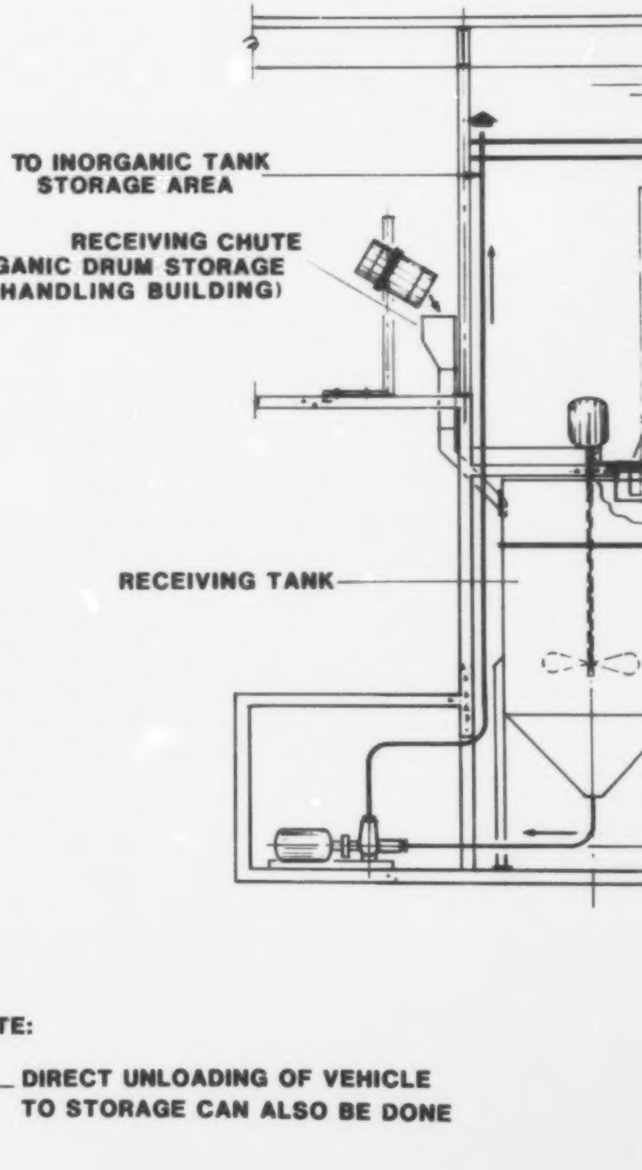
The inorganic tank truck unloading area comprises nine bulk waste unloading stations and will receive inorganic waste in the form of bulk pumpable liquids and/or sludges, which may contain gross solids; and bulk non-pumpable inorganic waste, which requires dissolution and/or slurrying prior to physical/chemical treatment; by road tanker and/or containers.

Once directed to the appropriate unloading area, vehicles reverse into the designated unloading station ready for unloading under the supervision of OWMC operations personnel.

All inorganic unloading stations are of similar design as illustrated in Figure 3.8. Each station has the capacity to unload vehicle contents directly to a storage tank located in the physical/chemical storage tank area using:

- the vehicle's own unloading pump, or
- the inorganic waste unloading pump.

Each unloading station also has the capability to unload vehicle contents to an in-ground unloading tank (of 25 m^3 capacity) using:


TO INORGANIC TANK STORAGE AREA
RECEIVING CHUTE (INORGANIC DRUM STORAGE AND HANDLING BUILDING)
RECEIVING TANK

NOTE:

_ DIRECT UNLOADING OF VEHICLE TO STORAGE CAN ALSO BE DONE

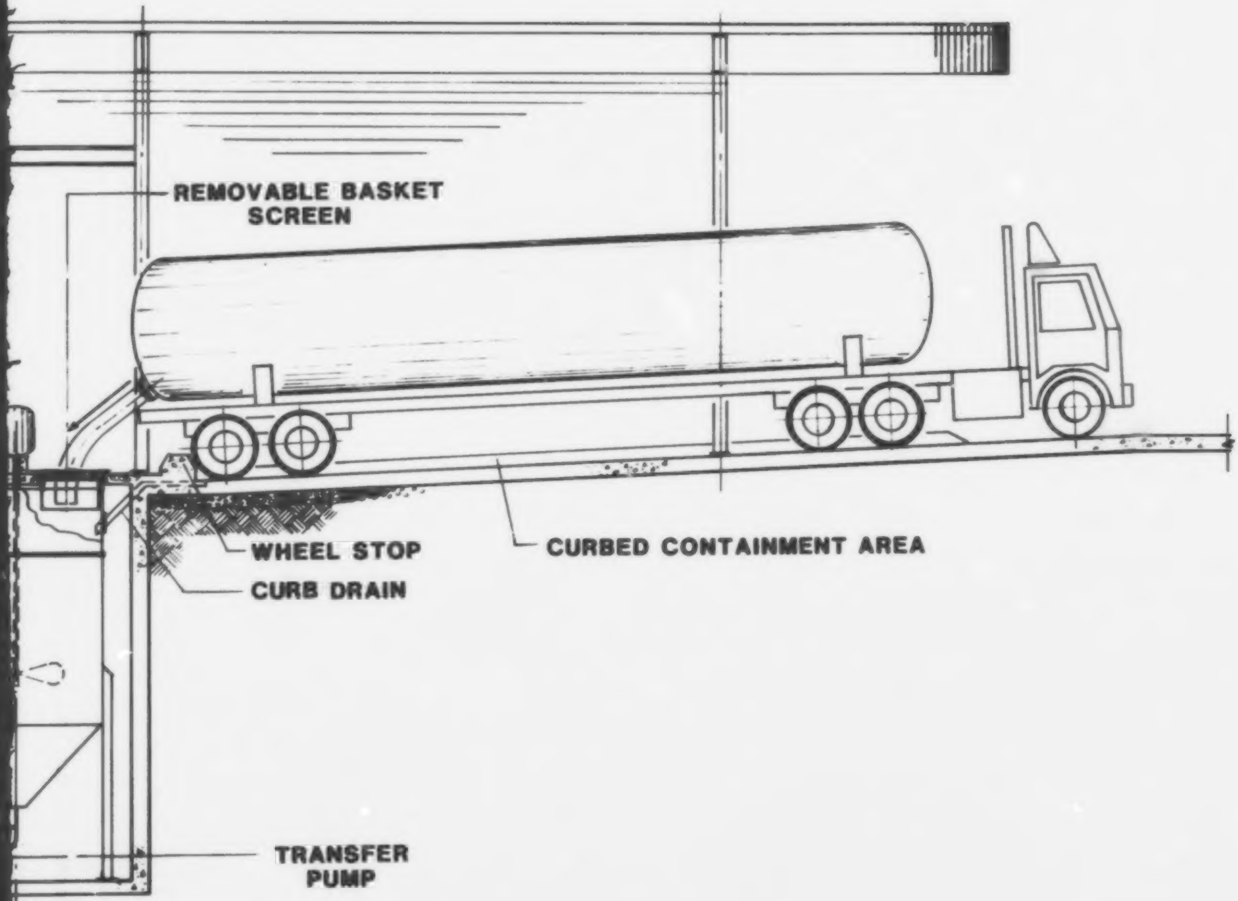

REMOVABLE BASKET SCREEN
WHEEL STOP
CURB DRAIN
CURBED CONTAINMENT AREA
TRANSFER PUMP

FIGURE 3.8

INORGANIC
BULK WASTE UNLOADING
PICTORIAL SCHEMATIC

- the vehicle's own unloading pump, or
- by gravity flow.

Where gross solids are present, these will be removed by a basket screen in the top of the unloading tank. Solids retained on the screen are removed periodically and transferred to the solidification plant for size reduction prior to further treatment.

This method of unloading, via the unloading tanks, is used for wastes containing gross solids, and for thick sludges which may require pretreatment (dilution) in the unloading tanks prior to being transferred to the storage tanks. Dilution is achieved by adding waste and water in the unloading tank, and by using the tank mixer. Experience from European waste treatment facilities indicates that this method of unloading is the normal procedure for inorganic wastes.

Inorganic wastes are pumped from the unloading station to a designated storage tank in the physical/chemical storage tank area using the inorganic waste unloading pumps.

Equipment and procedures for flushing pump suction and discharge lines and for flushing sludge or sediment remaining in the transport vehicle cargo hold are similar to those previously described for the organic tank truck unloading system (p. 34).

Design features of the inorganic stations with respect to containment, surface finishes, ventilation systems and weather protection are similar to those previously described for the organic tank truck unloading system, (pp 37-38).

Solidification Plant

Provision has been made at the solidification plant to receive the following wastes:

- dry solids and wet non-pumpable residues not requiring treatment in the physical/chemical treatment plant (p. 144),

- miscellaneous clean-up material not requiring treatment in the physical/chemical treatment plant (p. 146), and

- dry solids and wet non-pumpable inorganic wastes requiring size reduction and slurrying prior to treatment in the physical/chemical treatment plant (p. 147).

Inorganic Drum Storage and Handling Building

Trucks delivering inorganic waste in drums will be directed to the inorganic drum storage and handling building where the drums will be unloaded by forklift truck (p. 191).

3.2.3 NORMAL OPERATIONS

The following describes the operating philosophy that has been established for waste delivery and storage.

3.2.3.1 General

- Normal operating hours for receiving waste deliveries at the Facility will be 7:00 a.m. to 4:00 p.m. Monday through Friday.

- Generally wastes will be submitted in sample form for analyzing, characterizing and treatability testing prior to delivery to the Facility.

- Deliveries of waste will normally be pre-scheduled.

- Organic wastes in dry bulk solid form but containing free liquids or solid wastes containing high vapour pressure organics shall be delivered in drums.

- Wastes received at the Facility will be sampled:
    - bulk wastes on arrival, and
    - drums after being unloaded.

- Samples taken will be "fingerprint" tested to determine that the waste is that expected.

- Heterogeneous solid wastes such as contaminated construction materials will be accepted on the basis of a visual inspection and knowledge of the place of origin.

- Waste delivered in drums will be visually inspected upon arrival to confirm the number of drums and that drums are not damaged.

3.2.3.2 Gatehouse and Weighscales

- On arrival of the waste the incoming vehicle will be weighed and the accompanying documentation checked.

- The vehicle will then be directed to a dedicated area where personnel from the main laboratory will examine the waste documentation and take samples for "fingerprint" testing.

- Homogeneous bulk wastes will be sampled and a "fingerprint" test performed in the main laboratory located in the administration building (p. 244).

- Heterogeneous bulk solid wastes will be visually inspected and place of origin recorded.

- Waste delivered in drums will be visually inspected for damage and number of drums recorded.

- The vehicle will then be directed to the temporary organic or inorganic truck holding area to await verification of documentation and results of the "fingerprint" test before being directed to one of the truck holding areas (organic and inorganic) for unloading at one of the bulk waste unloading stations, or to one of the other designated unloading facilities.

- On departing the Facility, the vehicle will again be weighed in order to verify the quantity of waste delivered.

3.2.3.3 Truck Holding Area (Organic and Inorganic)

- Vehicles transporting bulk pumpable liquids and/or sludges (which may contain gross solids) will wait at the respective truck holding area until their designated unloading station is available.

- The vehicle will then be directed to its designated bulk waste unloading station at the respective tank truck unloading area.

3.2.3.4 Organic Tank Truck Unloading Area

- Unloading of waste will be performed by, or under the supervision of OWMC.

- The cargo hold will be inspected after unloading and any residues remaining will be flushed out.

3.2.3.5 Incineration Plant

- Vehicles transporting bulk organic solids will tip this waste into one of the two designated waste storage pits at the incinerator feed building.

- Alternatively, the waste will be removed from the vehicle and discharged into one of the waste storage pits by OWMC using special equipment.

- Vehicles transporting segregated organic wastes (such as PCBs pesticides, herbicides etc.) in custom fabricated containers will off-load the containers on to a concrete pad adjacent to the incinerator building.

- Vehicles transporting custom waste will be unloaded manually or using forklift trucks and the waste fed to the incinerator.

3.2.3.6 Segregated Organic Storage Tank Area

- Road tankers delivering segregated organic wastes (such as PCBs) will be unloaded at the segregated organic storage tank area.

3.2.3.7 Organic Drum Storage and Handling Building

- Vehicles transporting organic waste in drums will be unloaded at the organic drum storage and handling building, using forklift trucks.

- During unloading, drums will be inspected and any drum not considered to be in satisfactory condition will be placed in an overpack drum.

- Each consignment of drums will be placed in a separate area of the organic drum storage and handling building.

- Initially, all drums in a consignment will be opened for inspection and sampling and then resealed. Those containing non-homogeneous solids will be visually inspected. Those containing liquids and sludges will have a composite sample made up for "fingerprint" testing at the main laboratory in the administration building.

- After confirmation that the waste meets specification, each drum will be marked for identification and moved to a designated storage area to await processing.

3.2.3.8 Inorganic Tank Truck Unloading Area

- Unloading of waste will be performed by, or under the supervision of OWMC.

- The cargo hold will be inspected after unloading and any residues remaining will be flushed out.

- The vehicle will then be directed to the gatehouse to depart the Facility.

3.2.3.9 Solidification Plant

- Vehicles transporting dry solids and/or wet non-pumpable inorganic residues not requiring treatment in the physical/chemical treatment plant will be unloaded by tipping as follows:

    - dry solids into the dry solid residue pit, and
    - wet non-pumpables into the wet non-pumpable residue bin, located below grade.

- Vehicles transporting miscellaneous material resulting from clean-up operations outside the Facility will be unloaded by tipping into the miscellaneous clean-up solids pit.

- Vehicles transporting dry solids and/or wet non-pumpable inorganic residues requiring treatment in the physical/chemical treatment plant will be unloaded by tipping as follows:

    - dry solids into the solid inorganic pit (slurry system) and,
    - wet non-pumpables into the non-pumpables bin (slurry system).

3.2.3.10 Inorganic Drum Storage and Handling Building

- Vehicles transporting waste in drums will be unloaded at the inorganic drum storage and handling building, using forklift trucks.

- During unloading, drums will be inspected and any drum not considered to be in satisfactory condition will be placed in an overpack drum.

- Each consignment of drums will be placed in a separate area of the inorganic drum storage and handling building.

- Initially, all drums in a consignment will be opened for inspection and sampling, and then resealed. Those containing non-homogeneous solids will be visually inspected. Those containing liquids and sludges will have a composite sample made up for "fingerprint" testing at the physical/chemical laboratory in the physical/ chemical treatment building.

- After confirmation that the waste meets specification, each drum will be marked for identification and moved to a designated storage area to await processing.

3.2.4 ABNORMAL OPERATION OR UPSET CONDITION

The following outlines the waste handling and storage operating philosophies, safety features and emergency procedures of the process design which are aimed at containing and minimizing the effects resulting from abnormal operation or upset condition.

3.2.4.1 Non-Specification Waste

Wastes which fail the appropriate "fingerprint" test may be resampled and tested to determine if the waste is completely different from that authorized or whether there is a small but significant variation which could be due to poor sampling originally, contamination or the waste generator's process control.

After verification that the waste is not as specified, the following procedure will be followed:

- Facilities for unloading and isolating the waste, until a treatment process has been established, will be identified.

- The waste will either be unloaded as described in Section 3.2.2 (p. 33) or returned to the generator. If the waste is to be returned to the generator, OWMC will issue the necessary documentation in accordance with the appropriate regulations of the Ontario Ministry of the Environment.

Where waste in drums or containers, which will have been unloaded prior to sampling, is "fingerprint" tested and found not to be as specified, the wastes will be isolated and a "HOLD" label attached until their disposition has been determined.

3.2.4.2 Spills and Leaks

- Minor spills or leaks from unloading or receiving tanks, pump seals or valves will be contained for clean up by curbing around the base of the equipment. In addition, pumps are equipped with an integral base plate/drip pan.

- Spillage resulting from hose connections, a ruptured tank or through human error will be collected in segregated sumps. Any such spill will be contained within the local area and alarms will alert the operators that a spillage has occured.

- Bulk waste unloading stations at the organic and inorganic tank truck unloading areas will be surrounded by curbs and paved to contain spills in a segregated manner. Each curbed area including the unloading basins will have sufficient volume to contain the contents of the largest tank trailer.

- The waste unloading tanks and incinerator receiving tanks will be kept under slight negative pressure. This will minimize the escape of fugitive gaseous emissions.

- Intermediate waste receiving tanks will be blanketted by nitrogen gas to protect against explosion and fire.

3.2.4.3 Power Failure

- The plant control and status monitoring system is connected to an uninterruptible power supply as soon as the power fails. The ventilation fans and ventilation air scrubbing systems are connected to the emergency power supply.

- On return to normal power all systems will be restarted in an orderly sequence by the plant operators once the fault has been rectified.

3.2.4.4 Fire

Areas of the Facility where waste handling and unloading is carried out are provided with the following fire protection systems:

- Organic tank truck unloading area - external hydrants plus foam deluge water spray which activates automatically in the event of a fire.

- Inorganic tank truck unloading area - external hydrants plus water deluge spray which activitates automatically in the event of a fire.

- Incinerator waste receiving tanks - external monitor hydrants plus foam.

- Segregated organic storage tank area - external hydrants plus foam deluge water spray.

3.2.4.5 Emergency Provisions

- Emergency eyewash and shower stations are provided at strategic locations around the organic and inorganic tank truck unloading areas and the segregated organic storage tank area.

3.3 INCINERATION PLANT

The incineration plant comprises a rotary kiln incineration system for treating organic wastes.

This section describes the incineration plant (shown on Figure 3.2 as follows:

- waste storage and handling, and
- rotary kiln incineration plant.

Figure 3.9 provides a pictorial flow diagram of the incineration plant showing the main components.

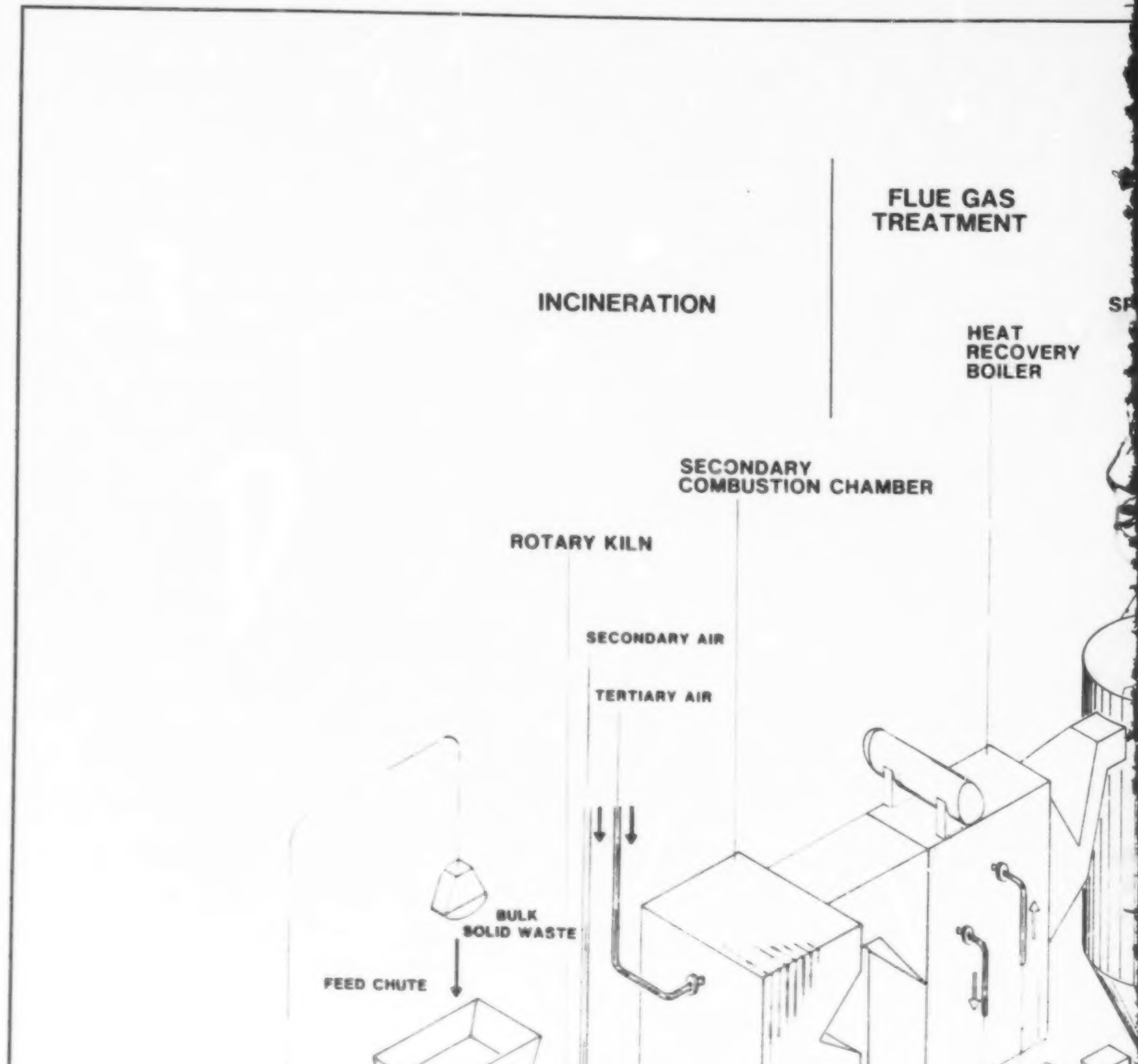
Figures 3.10 and 3.11 illustrate the conceptual equipment layout, in both plan and sectional views, of the incineration plant.

3.3.1 WASTE STORAGE AND HANDLING

Organic wastes will be fed to the incinerator in various physical forms including:

- pumpable liquids and sludges,
- dry bulk solids,
- drummed non-pumpable wastes, and
- custom waste containers.

The unloading and storage of these organic wastes is described in Sections 3.2.2.1 (p. 33), 3.7.3.1 (p. 168) and 3.7.4.1 (p. 185). Also described in Section 3.7.3.1 are provisions for the preparation of batches of organic pumpable liquids and sludges prior to incineration (p. 175).


FLUE GAS TREATMENT
INCINERATION
SP
HEAT RECOVERY BOILER
SECONDARY COMBUSTION CHAMBER
ROTARY KILN
SECONDARY AIR
TERTIARY AIR
BULK SOLID WASTE
FEED CHUTE
AQUEOUS ORGANIC WASTES FROM TANK FARM
PUMPABLE ORGANIC LIQUIDS AND SLUDGES
BOILER ASH CONVEYOR
GENERATED STEAM
FEEDWATER
SLAG QUENCH TANK
BUCKET ELEVATO
SLAG TO ENGINEERED LANDF
BULK SOLID WASTE STORAGE
DRUMS FROM DRUM HANDLING AR
PRIMARY AIR

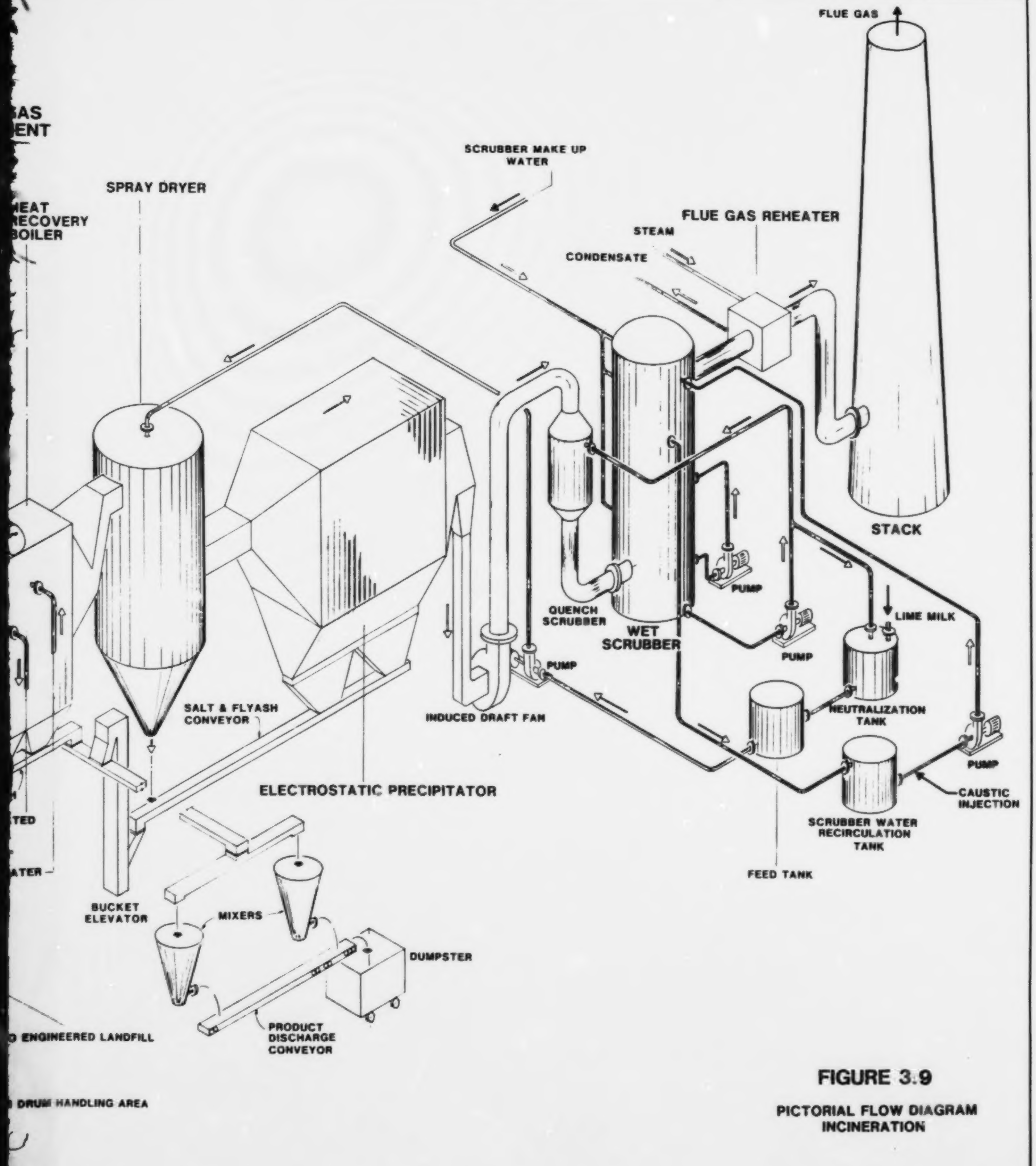
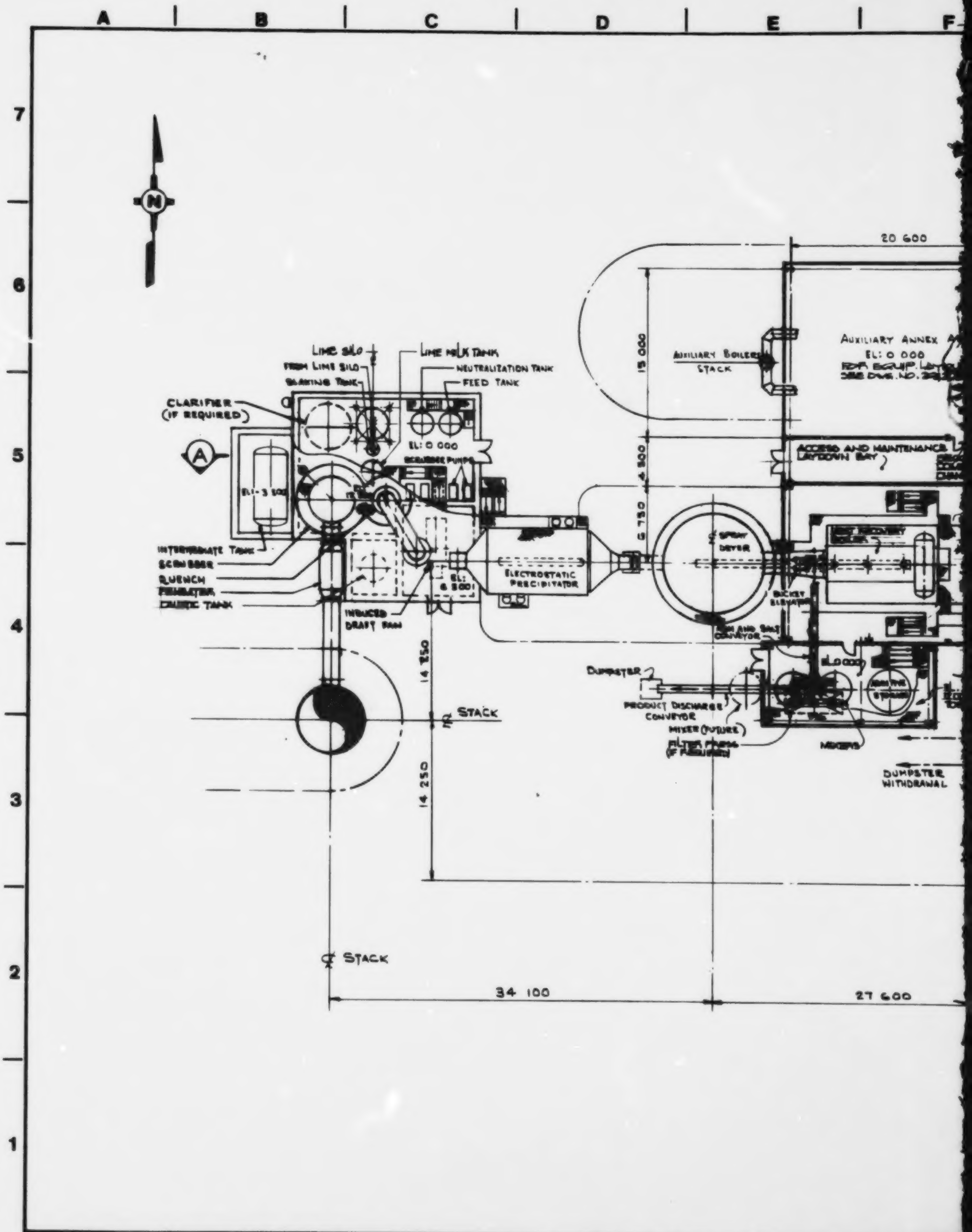

FLUE GAS
AS
ENT
HEAT
RECOVERY
BOILER
SPRAY DRYER
SCRUBBER MAKE UP
WATER
FLUE GAS REHEATER
STEAM
CONDENSATE
STACK
PUMP
QUENCH
SCRUBBER
WET
SCRUBBER
PUMP
LIME MILK
PUMP
INDUCED DRAFT FAN
NEUTRALIZATION
TANK
SALT & FLYASH
CONVEYOR
PUMP
CAUSTIC
INJECTION
ELECTROSTATIC PRECIPITATOR
TED
SCRUBBER WATER
RECIRCULATION
TANK
FEED TANK
ATER
BUCKET
ELEVATOR
MIXERS
DUMPSTER
O ENGINEERED LANDFILL
PRODUCT
DISCHARGE
CONVEYOR
D DRUM HANDLING AREA

FIGURE 3.9

PICTORIAL FLOW DIAGRAM
INCINERATION



A
B
C
D
E
F
7
6
5
4
3
2
1
N
LIME SILO
FROM LIME SILO
SLAKING TANK
LIME MILK TANK
NEUTRALIZATION TANK
FEED TANK
CLARIFIER (IF REQUIRED)
A
EL: 0 000
SCRUBBER PUMPS
EL: -3 500
INTERMEDIATE TANK
SCRUBBER
QUENCH
DEMISTER
CAUSTIC TANK
INDUCED DRAFT FAN
EL: 6 500
ELECTROSTATIC PRECIPITATOR
14 250
14 250
℄ STACK
℄ STACK
34 100
27 600
20 600
15 000
4 500
6 750
AUXILIARY BOILER STACK
AUXILIARY ANNEX
EL: 0 000
FOR EQUIP. LAYOUT SEE DWG. NO.
ACCESS AND MAINTENANCE LAYDOWN BAY
℄ SPRAY DRYER
HEAT RECOVERY BOILER
BUCKET ELEVATOR
ASH AND SALT CONVEYOR
EL: 0 000
DUMPSTER
PRODUCT DISCHARGE CONVEYOR
MIXER (FUTURE)
FILTER PRESS (IF REQUIRED)
MIXERS
DUMPSTER WITHDRAWAL

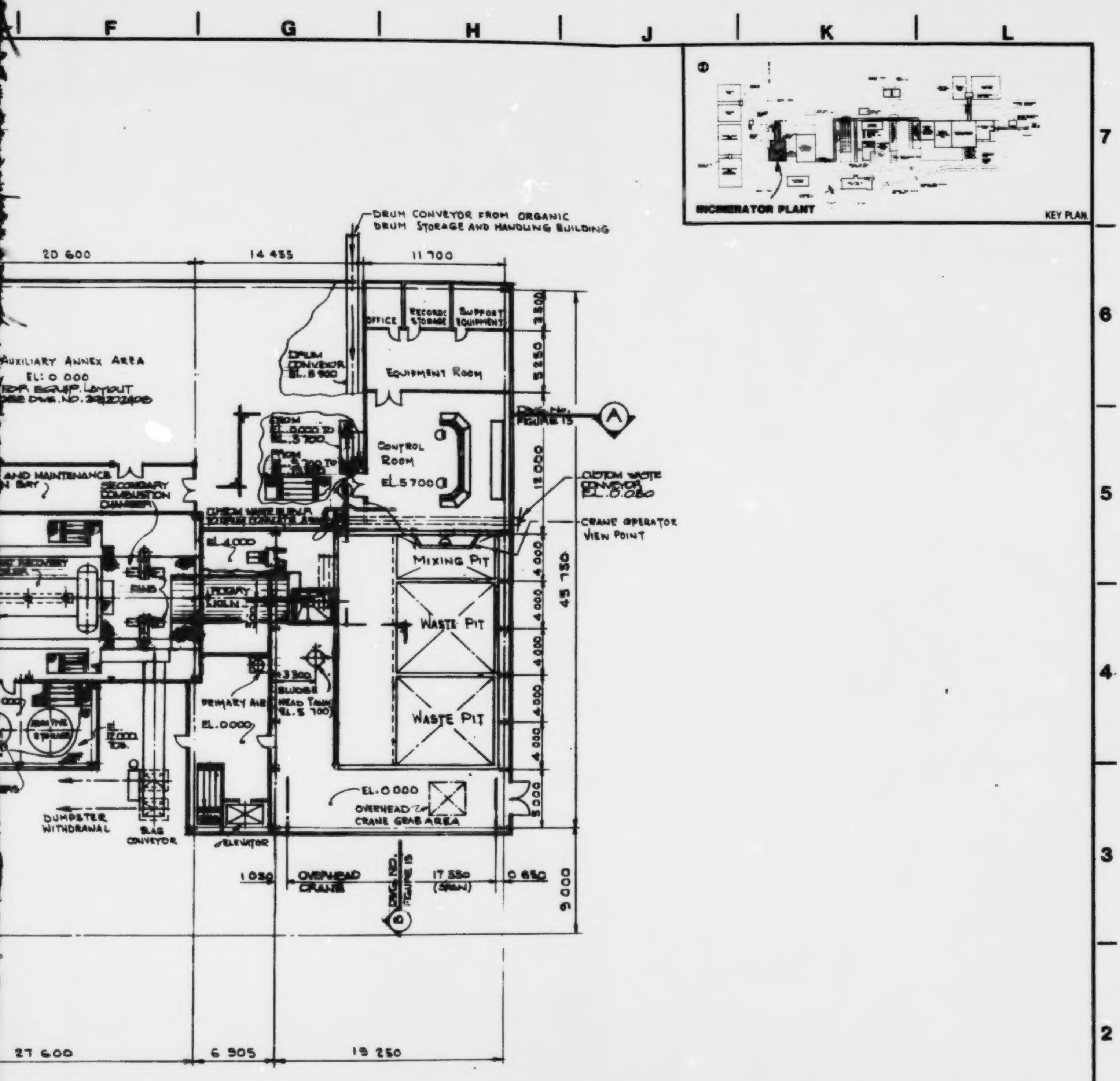
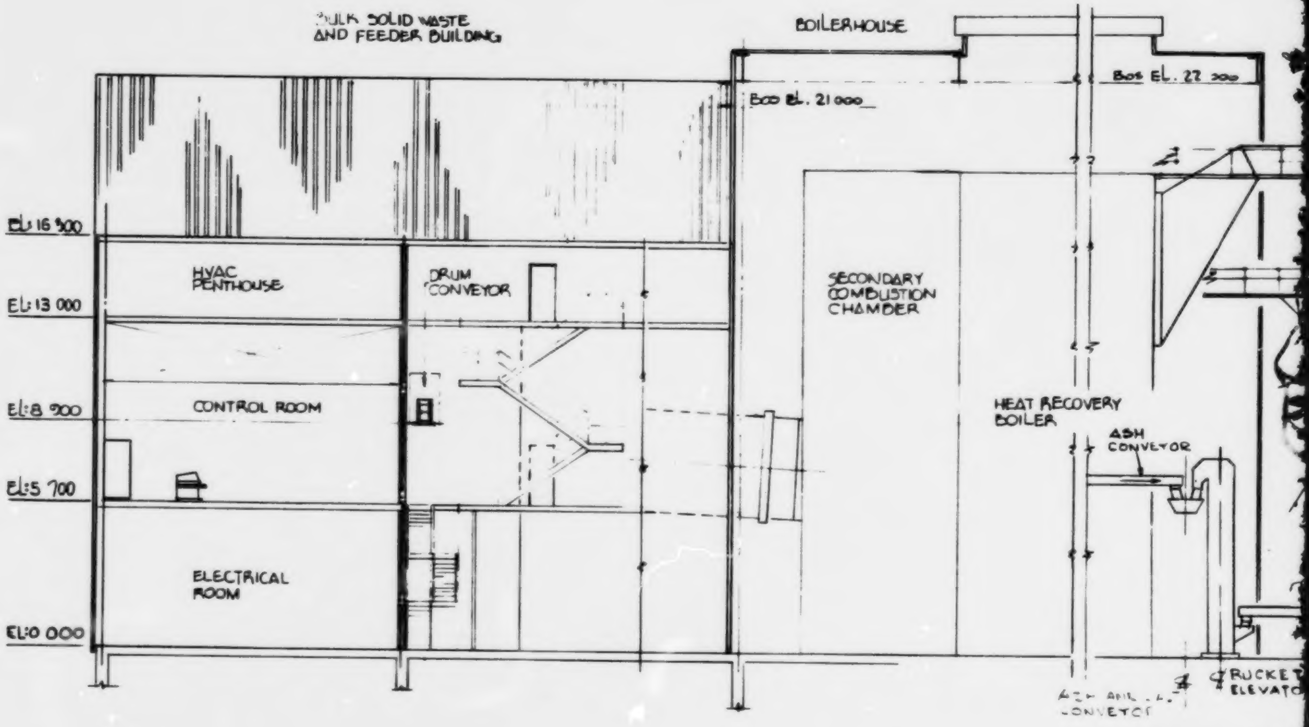

F
G
H
J
K
L
7
6
5
4
3
2
1
INCINERATOR PLANT
KEY PLAN.
DRUM CONVEYOR FROM ORGANIC DRUM STORAGE AND HANDLING BUILDING
20 600
14 435
11 700
OFFICE
RECORDS STORAGE
SUPPORT EQUIPMENT
EQUIPMENT ROOM
DRUM CONVEYOR EL. 8 900
AUXILIARY ANNEX AREA
EL: 0 000
FOR EQUIP. LAYOUT
SEE DWG. NO. 3312024
FROM EL. 0.000 TO EL. 5 700
FROM EL. 5 700 TO
CONTROL ROOM
EL. 5 700
DWG. NO. FIGURE 15
A
CUSTOM WASTE CONVEYOR EL. 8.000
CRANE OPERATOR VIEW POINT
AND MAINTENANCE
BAY
SECONDARY COMBUSTION CHAMBER
EL. 4.000
ROTARY KILN
FAN
MIXING PIT
WASTE PIT
WASTE PIT
3 300
SLUDGE HEAD TANK (EL. 5 700)
PRIMARY AIR
EL. 0.000
EL. 0.000
OVERHEAD CRANE GRAB AREA
ELEVATOR
DUMPSTER WITHDRAWAL
BAG CONVEYOR
EL. 12.000 TOS.
ASH STORAGE
3 250
5 250
18 000
4 000
4 000
4 000
4 000
3 000
45 750
9 000
1 030
OVERHEAD CRANE
DWG. NO. FIGURE 15
B
17 550 (SPAN)
0 650
27 600
6 905
19 250

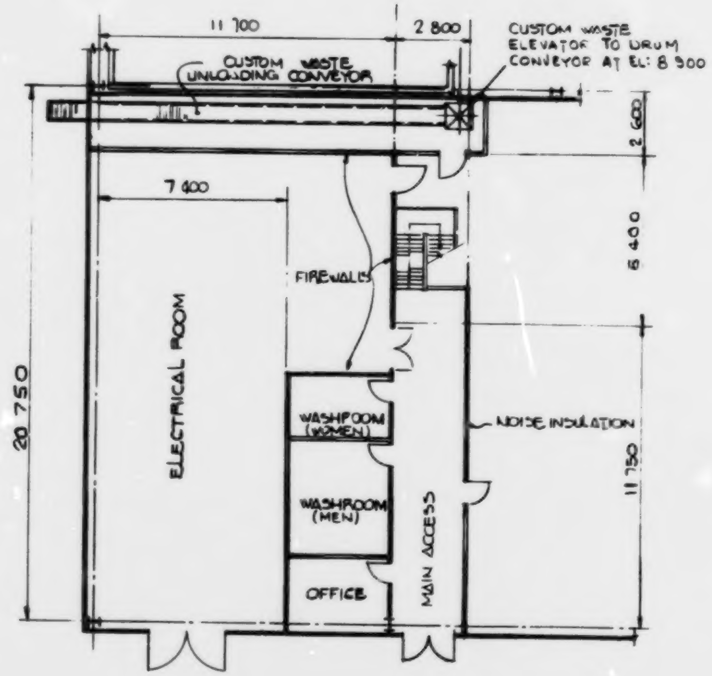
FIGURE 3.10

INCINERATION PLANT
CONCEPTUAL EQUIPMENT LAYOUT
PLAN

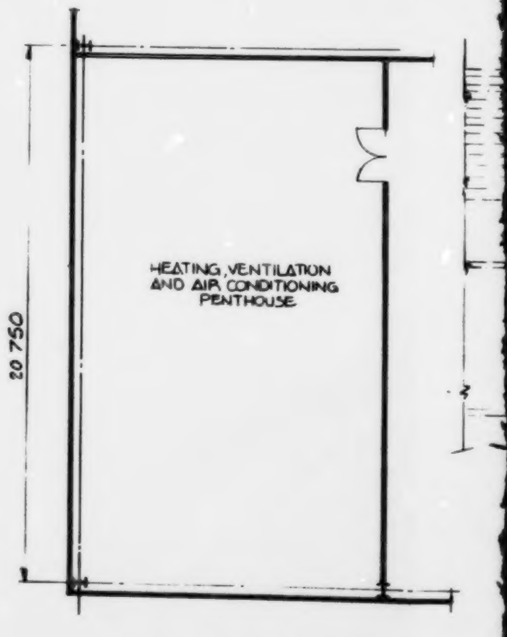
F
G
H
J
K
L


BULK SOLID WASTE
AND FEEDER BUILDING
BOILERHOUSE
BOS EL. 22 300
BOO EL. 21 000
EL: 16 300
EL: 13 000
EL: 8 900
EL: 5 700
EL: 0 000
HVAC
PENTHOUSE
DRUM
CONVEYOR
CONTROL ROOM
ELECTRICAL
ROOM
SECONDARY
COMBUSTION
CHAMBER
HEAT RECOVERY
BOILER
ASH
CONVEYOR
ASH HANDLING
CONVEYOR
BUCKET
ELEVATOR

SECTION "A-A"


11 700
2 800
CUSTOM WASTE
ELEVATOR TO DRUM
CONVEYOR AT EL: 8 900
CUSTOM WASTE
UNLOADING CONVEYOR
2 600
7 400
5 400
FIREWALLS
ELECTRICAL ROOM
20 750
WASHROOM
(WOMEN)
NOISE INSULATION
WASHROOM
(MEN)
MAIN ACCESS
11 750
OFFICE

ELECTRICAL ROOM AREA
PARTIAL PLAN VIEW
EL 0 000


HEATING, VENTILATION
AND AIR CONDITIONING
PENTHOUSE
20 750

HVAC PENTHOUSE
PARTIAL PLAN VIEW
EL 13 000

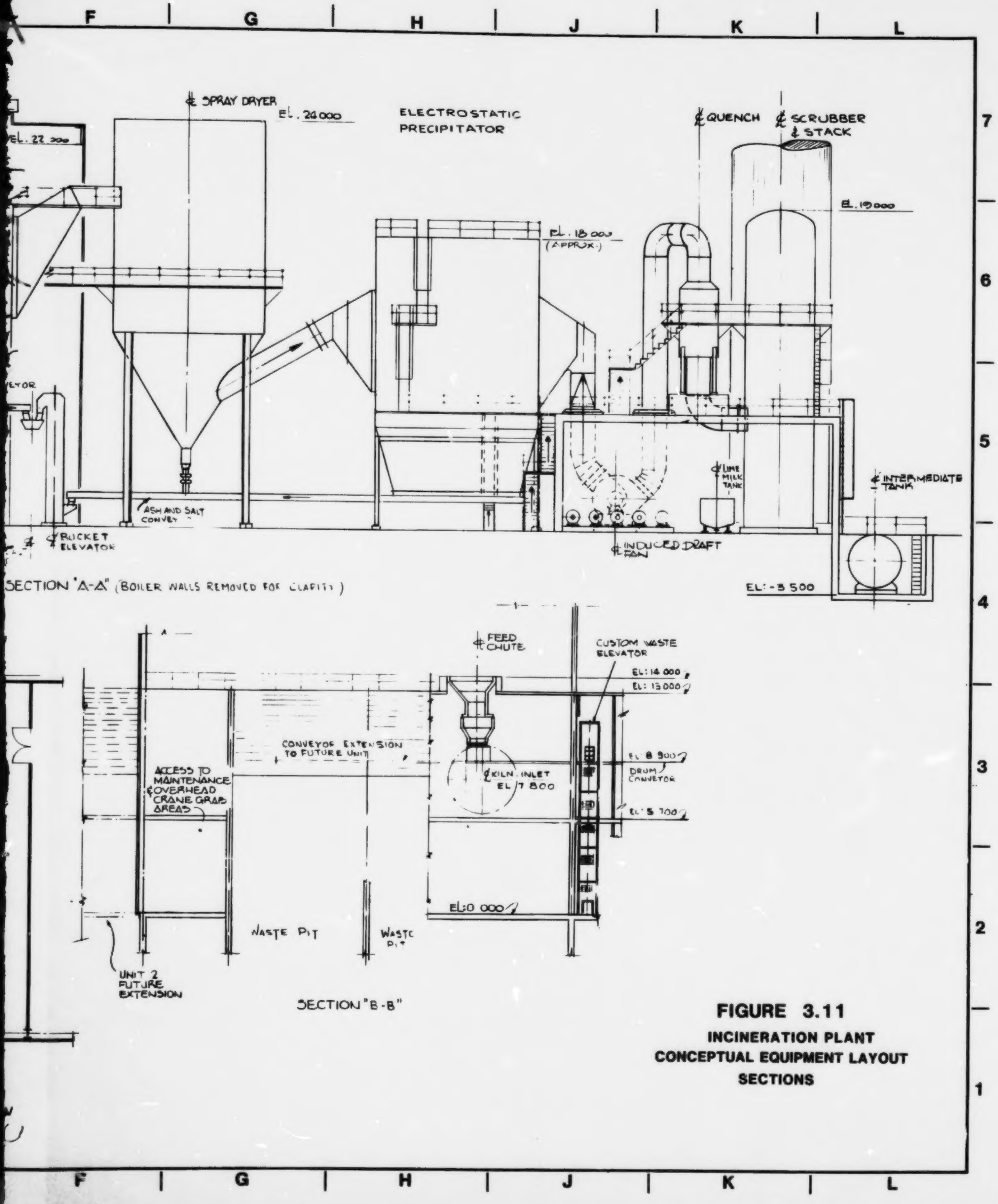

F
G
H
J
K
L
7
6
5
4
3
2
1
℄ SPRAY DRYER
EL. 24 000
ELECTROSTATIC PRECIPITATOR
℄ QUENCH
℄ SCRUBBER
℄ STACK
EL. 19 000
EL. 18 000 (APPROX.)
EL. 22 000
VEYOR
ASH AND SALT CONVEY
℄ BUCKET ELEVATOR
℄ LIME MILK TANK
℄ INTERMEDIATE TANK
℄ INDUCED DRAFT FAN
EL: -3 500
SECTION 'A-A' (BOILER WALLS REMOVED FOR CLARITY)
℄ FEED CHUTE
CUSTOM WASTE ELEVATOR
EL: 14 000
EL: 13 000
CONVEYOR EXTENSION TO FUTURE UNIT
ACCESS TO MAINTENANCE & OVERHEAD CRANE GRAB AREAS
℄ KILN. INLET EL 7 800
EL 8 900
DRUM CONVEYOR
EL 5 700
EL: 0 000
WASTE PIT
WASTE PIT
UNIT 2 FUTURE EXTENSION
SECTION "B-B"

FIGURE 3.11

INCINERATION PLANT
CONCEPTUAL EQUIPMENT LAYOUT
SECTIONS

3.3.1.1 Pumpable Liquids and Sludges

Pumpable liquids and sludges are provided with separate storage within the Facility as follows:

- organic liquids/solvents,
- organic liquids/oils,
- aqueous organics,
- sludges,
- halogenated wastes, and
- segregated organic wastes.

Organic liquids/solvents, organic liquids/oils, and halogenated wastes (and aqueous organic wastes if required) are blended in one of two waste blending tanks prior to incineration (p. 175).

Sludges (and aqueous organic wastes if required) are blended in one of two waste blending tanks prior to incineration (p. 176).

Aqueous organic waste is normally pumped directly from the storage tanks to the incinerator and not normally blended.

Segregated organic wastes (such as PCBs) are also transferred either directly from custom fabricated containers located at the incineration plant or from storage tanks located at the segregated organic storage tank area (p. 174).

3.3.1.2 Dry Bulk Solids

Low volatile dry solid waste such as contaminated soil or packaging material delivered to the Facility in dump trucks, tippable containers or tanker type vehicles are off-loaded and stored in enclosed solid waste pits in the incinerator feed building.

Crushed drums and drum caps are transferred to the waste pits from both the organic (p. 190) and inorganic (p. 194) drum storage and handling facilities. In addition, filter cake from the sludge dewatering process of the inorganic waste treatment system (p. 109), if of high organic content and/or requiring incineration, is transferred to the waste pits.

Overhead doors are used to control truck access to the solid waste pits and a canopy is provided over the doors to prevent ingress of rain into the pits while unloading. Three pits are provided for the storage of dry bulk solids, two each of 300 m^3 capacity for storage (the first assigned to normal size solid waste and the second to large size solid waste), and the third one of 150 m^3 capacity for mixing waste prior to incineration.

The waste pits are designed with a double containment feature to prevent the ingress of water to the pits during high water table conditions, and to minimize the possibility of contaminant leakage to the environment. An inspection sump is provided to permit the detection of any free liquids at the bottom of the pits, which will be approximately 5 m below ground level.

Solid waste is fed from the pits to the incinerator feed chute hopper by means of the overhead crane, which is also used to mix the solid waste in each separate pit section.

The operator will be able to observe crane movement through a special glassed viewing area in the control room (see Figure 3.10). The designated location provides line-of-sight contact with all areas of the solid waste pits except for the feed chute hopper at the top of the rotary kiln which is viewed using a closed circuit television camera and monitor. The ascent of the load and control governing acceleration, deceleration and routing to the feed hopper is automated and an interlock allows travel to the hopper only when the kiln is ready to receive a load of solid waste. The crane is equipped with a weighing device to limit the weight of a load, prevent overcharging the kiln and to record processing data.

The incineration feed building is ventilated to minimize release of dust and organic vapours to the environment during vehicle unloading and also to eliminate the opportunity for concentrations of organic vapours to buildup in the pit enclosure as follows:

- primary combustion air for the incinerator is drawn from this building, and

- additional roof mounted ventilation fans are provided for use when the incinerator is not working or to supplement the primary air fan should the need arise.

3.3.1.3 Drummed Non-Pumpable Wastes

Drums containing mainly wet or highly volatile non-pumpable wastes, which are unsuitable for depositing in the waste pits, are transported to the incineration plant on an elevated drum conveyor from the organic drum storage and handling building (p. 185).

3.3.1.4 Custom Waste Containers

To accommodate for the capability to handle custom waste (such as biomedical waste or security documents), a loading conveyor, two pusher devices, an elevator and a transfer conveyor dedicated to the handling of this waste are provided (see Figures 3.10 and 3.11).

Biomedical waste will be delivered to the Facility, by truck, in approved plastic lined cardboard boxes or rigid plastic containers suitably labeled (including the bio-hazard logo) colour coded for their particular contents and usually processed upon arrival.

Custom waste containers will be manually transferred to the custom waste loading conveyor without being opened. The containers then travel along the conveyor in an enclosed corridor. At the end of the conveyor, a pusher device transfers the containers, one at a time, to a waste elevator. The elevator lifts the container to the same elevation as the drum conveyor. At this point a second pusher device moves the containers from the elevator to the transfer conveyor. The transfer conveyor transfers the containers to the drum conveyor for feeding to the rotary kiln feed chute.

3.3.2 ROTARY KILN INCINERATION PLANT

The rotary kiln incineration plant comprises the following systems:

- combustion system,
- flue gas cooling system,
- flue gas treatment system,
- flue gas reheating,
- stack,
- residue handling systems,
- reagent storage and handling systems,
- auxiliary systems,
- control centre and offices, and
- mechanical and electrical rooms.

3.3.2.1 Combustion System

The combustion system is the heart of the incineration process since it is here that organic materials are destroyed by high temperature thermal oxidation.

The combustion system includes:

- waste feeding system,
- rotary kiln, and
- secondary combustion chamber.

Waste Feeding System

The waste feeding system comprises:

- burners,
- liquid waste and sludge lances,
- drummed waste feed euipment,
- solid waste feed equipment,

- primary combustion air system, and
- cooling system.

Burners. Three natural gas fired burners (each rated at 21 GJ/h) are provided, one located in the front wall of the rotary kiln and the other two located on opposite walls of the secondary combustion chamber. They are used for:

- start-up of the incineration process, by raising the incinerator temperature in a controlled manner,
- maintaining the combustion temperatures above predetermined limits during normal operation, if so required,
- maintaining combustion temperatures above predetermined limits during shut-down of the process, and
- controlling the rate of refractory cooling during a planned shutdown.

The burner in the front wall of the rotary kiln is of a dual fuel design to allow for either the combustion of natural gas alone or the simultaneous combustion of both natural gas and segregated organic wastes.

These segregated organic wastes such as PCB-contaminated liquids, are transferred from storage tanks in the segregated storage tank area, or from custom fabricated containers located at the incineration plant, to the burner gun, which introduces this waste through the kiln front wall up to a maximum capacity of 300 kg/h. Burner controls are arranged such that even though the operating temperature in the secondary combustion chamber is sufficient for thermal destruction of the waste, natural gas auxiliary fuel must be firing in the burner before the segregated organic waste is introduced. The waste is then introduced directly into the auxiliary fuel's flame envelope.

Liquid Waste and Sludge Lances. Waste feed lances are used to inject pumpable waste in a dispersed stream so that heating, vaporization and ignition of the waste occurs in the first section of the rotary kiln. Waste liquids and sludges will be injected in a dispersed stream to achieve optimum combustion conditions. Combustion then takes place in the middle section of the rotary kiln with residue burnout in the last section.

The following lances are provided:

- One sludge lance, liquid cooled for protection against the radiant heat of the kiln, and located in the front wall of the rotary kiln. The sludge lance is equipped with a special end-piece that utilizes steam to break up the stream of sludge evenly over the top of the other waste in the kiln, thus assuring complete combustion of the sludge. Provision is also included for steam cleaning the sludge lance when taking the lance out of service or on shutdown of the incinerator.

- One organic (liquid) waste lance, liquid cooled for protection against the radiant heat of the kiln, and located in the front wall of the rotary kiln. Provision is included for dispersion of the organic waste into coarse droplets using steam atomizing. Steam is also used for cleaning the lance when taking it out of service or on shutdown of the incinerator.

- One aqueous waste lance located in the front wall of the rotary kiln. This lance is cooled by the flow of aqueous waste through the lance. Provision is included for dispersion of the aqueous waste into coarse droplets using steam atomizing.

- Two aqueous waste lances located in opposite sidewalls of the secondary combustion chamber. These lances are also cooled by the flow of aqueous waste through them. Provision is also included for dispersion of the aqueous waste into coarse droplets using steam atomizing.

The sludge lance, is rated at 4000 kg/h, and receives blended sludges pumped from the sludge head tank. The sludge head tank acts as buffer storage local to the incinerator, for blended sludges pumped from the waste blending tanks (p. 175).

The organic (liquid) waste lance is rated at 2000 kg/h and receives blended liquids pumped from the waste blending tanks (p. 175).

The aqueous waste lances are each rated at 500 kg/h and receive aqueous organic waste pumped from the aqueous organic waste storage tanks (p. 170).

Drummed Waste Feed Equipment. Drummed waste is conveyed from the organic drum storage and handling building (p. 185) to the incinerator feed chute prechamber, which serves as an air lock to limit air leakage into the kiln or the escape of combustion gases to atmosphere. The prechamber is equipped with a hydraulically operated double gate system. With the second or discharge gate at the feed chute closed, the first or feed gate at the conveyor opens and one drum is pushed into the chamber by a hydraulically operated pusher plate. After the first gate is closed, the discharge gate opens and a second pusher plate pushes the drum into the feed chute where it slides into the kiln. The system is rated to accommodate drums weighing 200 kg each and also designed to receive 320 litre overpack drums each at a rate of 10 drums per hour.

This system will be utilized to convey custom waste to the incinerator. Biomedical waste will not be stored but will be processed as received. Prior to introducing biomedical waste or other custom waste containers to the drum conveyor, drum feed from the organic drum storage and handling building is halted until all biomedical waste custom waste containers have been fed to the kiln. The system is rated to accommodate containers up to a maximum of 200 kg each at a rate of 10 containers per hour.

The discharge gate of the prechamber is liquid cooled and constructed of heat and corrosion resistant steel and shields the interior of the prechamber from the radiant heat of the kiln.

Solid Waste Feed Equipment. Solid waste fed to the kiln by the overhead crane is received in a feed chute hopper configuration with steeply sloping sides. The hopper is equipped with a hydraulically operated double gate system to limit air leakage into the kiln or the escape of combustion gases from the kiln during bulk solid waste feeding. The first gate or feed gate opens to receive the waste from the crane. After the first gate is closed, a second or discharge gate opens allowing the waste to fall through the feed chute and into the kiln. The system is designed to feed solid waste pieces up to 1 m long by 0.5 m wide and deep at a rate of 12 cycles per hour.

The discharge of the hopper is liquid cooled and constructed of heat and corrosion resistant steel and shields the interior of the hopper from the radiant heat of the kiln.

The feed chute extends into the kiln so that drums and loose solid waste are injected well into the first zone of the kiln. This feature eliminates both erosion of the refractory brick on the front wall of the kiln and damage to the burners and lances in the front wall that results from tumbling waste. The front end of the kiln is tapered to prevent the waste from flowing backwards.

The feed chute and prechamber are liquid cooled to minimize thermal stress and prevent ignition of waste in the feed chute.

Primary Combustion Air System. The primary air fan draws primary combustion air from the incinerator feed building and conveys it in air tight ducting to the front wall of the rotary kiln. Primary combustion air enters the kiln through an opening in the lower section of the front wall. A steam-to-air heat exchanger is provided to preheat primary combustion air to 130°C during wintertime and whenever the mean heating value of the waste being incinerated falls below a certain limit. Primary air flow is regulated through a discharge louvre damper.

In addition, vapours (vent gases) from certain organic emission control systems of the vent gas cleaning systems (p. 238) are normally piped to the incinerator. They enter the kiln through an opening in the lower section of the front wall.

Cooling System. A cooling system is used to cool the waste feed chute, hopper discharge gate, prechamber discharge gate, the lower half of the front wall of the kiln, the sludge lance and the organic (liquid) waste lance. The coolant is a mixture of water and glycol to provide a high boiling point and low freezing point. An air-to-liquid heat exchanger is utilized to regulate the temperature of the coolant by varying the flow of air over the heat exchanger cells in response to the temperature of the coolant as it leaves the front wall components. The temperature is maintained at a point that:

- prevents the chute and other parts of the feed system from overheating,

- prevents premature ignition of the waste spilling onto the inside surface of the waste feed chute, and

- minimizes condensation of corrosive flue gas substances on metal surfaces exposed to the flue gas.

Rotary Kiln

The kiln shell has internal dimensions of 4 m diameter by 11 m long, and is constructed of steel and lined with refractory. The feed end of the kiln is conical to prevent back flow of loose solid wastes and sludges between the kiln and the front wall. The discharge end of the kiln is tapered to retain a molten slag pool. Steel castings mounted on the discharge end of the kiln retain the refractory at that end of the kiln. These castings are air-cooled to prevent heat damage.

An external kiln shell water cooling system, located longitudinally along the kiln on both sides, controls the shell temperature and thickness of the solidified slag layer on the refractory lining inside the kiln. The solidified slag layer protects the refractory lining from wear due to erosion and corrosion, and thereby extends refractory life.

The kiln shell is designed for minimum deflection and distortion at all operating temperatures.

The drive mechanism for the kiln consists of two independent oil pumps, a variable speed hydraulic motor and driving sprocket.

The kiln support rings rest on two pairs of heavy duty rollers which cradle the kiln shell and restrict lateral movement. Two thrust rollers engage the forward steel support ring and prevent longitudinal movement of the kiln. The drive mechanism, kiln support rollers and thrust rollers are mounted on a structural steel base.

The kiln is inclined with a declination angle of 3^o to the horizontal and rotates at 0.1 to 0.6 revolutions per minute.

Front Wall. The front wall serves as the structural frame work which supports the refractory lining on the kiln side, and the feed chute, prechamber, burner, lances, combustion air inlet duct, feed hopper and access platforms on the exterior side. The undercarriage supports the entire feed system and front wall assembly and provides for limited mobility on rails.

The front wall of the kiln is lined with a combination of fire bricks and castable refractories.

Refractory and Castings. The refractory lining protects the kiln shell from overheating and chemical attack while providing a hot surface to aid in the ignition and combustion of waste. Common types of refractory cannot be used for this application. The lining consists typically of three types of refractory brick whose selection will be based on the duty along the length of the kiln. A special type of refractory brick, manufactured with high concentrations of alumina and a special binder is to be used at the discharge end.

Final selection of the refractory for the critical areas will be determined from laboratory testing of alternative refractories in order to evaluate refractory porosity, scaling and corrosion effects with representative molten slag.

The discharge end of the kiln serves as the refractory lining stop and is forced-air cooled, with the heated air discharged back to the atmosphere.

Kiln Seals. Seals located at the kiln intersection with the front wall and with the secondary combustion chamber minimize both the premature cooling of the flue gas caused by leakage of air into the kiln and the leakage of combustion gas out of the kiln, in the event of a positive pressure surge. Both of the seal mechanisms are designed to withstand high temperatures and minimize wear. They seal against the kiln shell on the front wall side and against the kiln discharge end assembly on the secondary combustion chamber side.

Kiln Shell Cooling Systems. The rotary kiln shell and refractory are protected from the thermal extremes of the combustion process by an external cooling water spray. This system consists of spray nozzles running longitudinally along the kiln on both sides. The nozzle row on each side of the kiln is totally enclosed by a sheet metal enclosure to collect the water vapours rising from the kiln shell. These vapours are sent to the building roof by a vapour fan and ducting, and discharged to the atmosphere. Water not evaporated is collected in a drip pan.

Staged Combustion. Staged combustion of the waste provides for a stable and controlled combustion process. The first stage of combustion takes place in the evaporation zone of the kiln. During this stage, the waste is heated gradually and the organic content vaporized. Very little ignition of the waste takes place during this first stage. Combustion air is introduced at a predetermined rate at the bottom of the kiln front wall below the waste feed mechanisms. This method for feeding waste and combustion air into the kiln enhances the controlled heating and vaporizing process.

The second zone of the kiln is the area in which primary combustion of the waste takes place. Oxidation of the vaporized waste occurs as it mixes with the combustion air. The last zone of the kiln is the area in which burnout of the waste is maximized.

Molten Slag Pool. The molten slag pool is formed by the combination of non-combustible residue from the waste, steel drums and silicon based compounds which are injected into the kiln periodically to adjust the consistency of the slag. The eutectic combination of non-combustible material and silicon has a melting temperature lower than the flue gas temperature in the second half of the kiln. The molten slag pool assures maximum destruction of solid residues and provides for some fixation of heavy metals from the residue. This fixation reduces the leachability of heavy metals from the residue. The molten slag pool also melts steel drums and other steel containers.

Combustion Control. Control of the combustion process involves accounting for the heat content and oxidation rate of each waste, and then scheduling the mixing and injection rate of the waste such that the heat release in the kiln is relatively constant. Aqueous liquids and sludges are injected at predetermined constant rates, resulting in a relatively constant release of heat. Drummed and other batch feed wastes are also injected at predetermined regular intervals and release additional heat. Because of the nature of the batch feed process, this heat release is not constant. High heating value liquids from the waste blending tanks (p. 175) are injected at a modulated rate to release additional heat as and when required to even out the total combined heat release.

Secondary Combustion Chamber

Combustion flue gases, including partially combusted volatile gases, flow from the rotary kiln to a refractory lined secondary combustion chamber where a combination of residence time, temperature, turbulence and the provision of additional (secondary) combustion air results in the completion of combustion and destruction of organics with extremely high efficiencies.

The flue gas temperature is maintained by minimizing heat losses and ambient air leaks, which may cool the flue gas prematurely. A set of seals limit air leakage at the points where the rotating kiln intersects with the stationary front wall and the secondary combustion chamber. A quench tank containing cooling water forms the water seal around the opening in the bottom of the secondary combustion chamber through which non-combustible residue from the kiln and flyash particles from the secondary combustion chamber are removed. The envelope of the secondary combustion chamber includes a welded, gas-tight steel skin lined with an insulating layer and refractory bricks. The chamber is also insulated externally to reduce heat loss.

In general, the secondary combustion chamber provides for vertical flow of flue gas and the size of the secondary combustion chamber is based on the required flue gas residence time. The effective volume, or volume occupied by the moving flue gas, that is used to determine residence time of the flue gas is approximately eightyfive percent of the total actual volume.

The rotary kiln incinerator operates at temperatures ranging from 1000°C to 1400°C in the high temperature zone, prior to the introduction of secondary air. The flue gas residence time at these temperatures is always greater than 3 seconds at full load operation, and can be increased to over 5 seconds by operating at reduced incinerator load (70% full load).

All of the interior surfaces of the secondary combustion chamber are vertical or steeply inclined. This configuration, together with vertical flow of the flue gas, minimizes deposits of flyash in the secondary combustion chamber and provides for separation, by gravity, of some of the larger flyash particles.

These particles, along with the slag from the kiln, fall through a chute into a water filled quench tank at the bottom of the secondary combustion chamber. The particles and slag are cooled and solidified in the quench tank and this material is then removed automatically from the quench tank and conveyed to a portable drop box type container.

The chute is included as part of the secondary combustion chamber structure and extends into the water in the quench tank. This ensures an air tight seal of the chamber while providing a cooling media for the slag.

Refractory Lining. The secondary combustion chamber is lined with one layer of high alumina refractory brick, two layers of insulating brick and a mineral wool blanket. The refractory system is zoned (that is, different refractory for different locations), high alumina bricks are used in critical areas, castable refractory may be used in certain areas such as burner ports. Supports and hangers are provided to ensure installation of the refractory system within the tolerances necessary for satisfactory performance.

The shell of the secondary combustion chamber is covered with insulation and cladding to maintain an internal steel shell temperature of at least 160°C to prevent low temperature corrosion. The external cladding temperature is approximately 55°C under average operating conditions.

Secondary Air Injection. The secondary combustion air system injects ambient air into the flue gas stream exiting the kiln. This creates extreme turbulence in the flue gas stream, thereby mixing semi-oxidized combustibles with oxygen to assure complete combustion of the waste and a minimum emission of carbon monoxide and hydrocarbons.

The secondary air fan is mounted on the secondary combustion chamber roof and includes a silencer installed on the suction side of the fan. The discharge side is regulated through a louvre damper. The secondary combustion air is conveyed in an air tight duct and injected through nozzles perpendicular to the flow of flue gas. These nozzles are located on two opposing sides of the secondary combustion chamber and impart sufficient velocity to the secondary air for complete penetration of the flue gas stream.

3.3.2.2 Flue Gas Cooling System

Flue gas discharged from the secondary combustion chamber is cooled to protect the flue gas cleaning equipment. A convective type waste heat recovery boiler preceded by air cooling, using tertiary air, is provided for this purpose. The tertiary air system optimizes boiler performance by maintaining the temperature of the flue gas at a constant level by modulating the amount of cooling air automatically.

In addition, two baffles are placed in the secondary combustion chamber to ensure that the flue gas enters the boiler with a relatively consistent velocity profile.

Tertiary Air Injection

Tertiary air is added to cool and condition the flue gas to approximately 750°C before it enters the waste heat recovery boiler. A fan, duct and nozzle arrangement similar to that used for secondary air injection is provided, with the tertiary air nozzles located on two opposing sides of the secondary combustion chamber. The flow of tertiary air is regulated through a louvre damper located at the fan discharge side and controlled automatically based on the flue gas temperature.

Waste Heat Recovery Boiler

The waste heat recovery boiler of the convective type incorporates the features of horizontal gas flow in the evaporator and superheater sections and provides for natural circulation of steam and boiler water. The boiler contains three evaporator sections and two superheater sections. Vertical tube sections are connected to two water headers running longitudinally along the bottom of the boiler and the boiler drum located perpendicular to the longitudinal axis of the boiler. The side walls and roof of the boiler are constructed from finned tubes welded together to form a gas tight box. The refractory lined baffles and roof of the secondary combustion chamber are integral with the boiler evaporator sections.

The boiler is constructed of carbon steel with refractory lining in the first ash hopper and on the inclined portion of the radiation chamber. The boiler and steam drum are fully insulated and encased in cladding. The steam drum and associated controls are mounted in an enclosure on the roof of the boiler.

The flue gases are cooled to 325°C in the waste heat recovery boiler. In the initial design, it is assumed that the boiler will produce 16 t/h of steam at a pressure of 2750 kPa and a temperature of 300°C. The final operating pressure and temperature will be established during detailed design of the steam system.

Approximately 60% of the heat produced by the incineration of waste is recovered and converted into steam which can be used within the Facility.

A mechanical rapping mechanism is provided for cleaning the horizontal gas flow section of the boiler during operation. This mechanism vibrates each individual tube bundle at predetermined intervals. The bottom cross headers of the boiler tube banks are arranged to allow fly ash removed during rapping to fall unobstructed into the boiler hoppers. This system includes hammers, striking pins, shafts, a variable speed drive and controls.

3.3.2.3 Flue Gas Treatment System

The flue gas treatment system includes an electrostatic precipitator and and a three stage wet scrubbing system. In addition, a spray dryer is used to evaporate liquid effluent from the scrubber utilizing the heat of the flue gas.

Spray Dryer

The spray dryer is the first step after the waste heat boiler in the flue gas treatment system. Scrubber effluent is atomized in the spray dryer and mixed with hot flue gases in such a manner that all free water is evaporated. Evaporation of the water results in a dry free flowing powder and at the same time cools the flue gas to 160°C. The effluent is limited to approximately 20% maximum total solids concentration in order to assure proper atomization in the spray dryer.

The flue gas leaving the boiler is introduced through a spiral shaped duct on top of the spray dryer which spins the flue gas within the vessel. The scrubber liquid effluent is injected into the spinning flue gas and atomized by means of a high speed rotating disc. The atomized scrubber effluent cools the flue gas by evaporation of the water in the scrubber effluent. The solids in the effluent are dried and entrained in the flue gas and large flyash particles are removed in the spray dryer by the centrifugal force resulting from the spinning of the flue gas. The smaller fly ash particles act as nuclei for the condensation of heavy metal salts in the flue gas. Particles separated from the flue gas in the spray dryer are removed from the bottom of the vessel through a dual chamber air lock system.

The spray dryer is designed to evaporate water in the atomized scrubber effluent before any droplets can impinge upon the vessel walls and cause buildup and corrosion. To prevent corrosion caused by the condensing of acids in the flue gas, the temperature of the flue gas leaving the spray dryer is maintained at or above 160°C by modulating the amount of scrubber effluent that is introduced to the spray dryer.

In cooling the flue gas from 325°C to 160°C, the spray dryer disposes of all the scrubber effluent up to a waste chlorine content of 11.5% and a sulphur content of 1.5%. Peak chlorine and sulphur contents above these values can be tolerated for a maximum period of approximately seven hours, beyond which some scrubber effluent may have to be discharged to the physical/chemical treatment plant to avoid buildup of dissolved solids concentrations above acceptable levels in the scrubber liquor. A storage tank complete with agitator is provided to buffer the flow of scrubber effluent going to the spray dryer.

Flue gas is introduced at the top of the spray dryer through a specially profiled gas distributor and scrubber blowdown is introduced through a disk rotating at high speed for atomization. These components are constructed of heat, corrosion and abrasion resistant alloys. The spray dryer is constructed of carbon steel and is heated and insulated to prevent corrosion. The hopper includes an air lock valve to discharge dried salts to the ash removal conveyor.

Electrostatic Precipitator

The second part of the flue gas treatment system consists of a three-field electrostatic precipitator, with a particulate removal efficiency of 99%. The precipitator is of the rigid electrode or rigid frame design with each field independent.

The precipitator is equipped with a rapping system to remove flyash from the collecting surfaces. Hoppers are provided under the collecting surfaces to collect the flyash for removal by a conveying system. The precipitator and the hoppers are insulated and heated to prevent condensation of acid gases on interior surfaces. Flyash and salt from the precipitator are combined with flyash and salt from the spray dryer and discharged to the residue handling systems (p. 76).

The precipitator casing and collecting surfaces are fabricated from carbon steel.

The precipitator consists of three mechanical and electrical fields through which the flue gas must pass. Each field has an independent high voltage power supply. Since the inlet field encounters the highest dust load, it will have the greatest disturbance of electrical field stability. Therefore, the independence of the three fields allows the second and third fields to operate with more stability, for improved performance.

Each electrical field has an independent, solid state control system. An automatic control amplifier maintains optimum power input to the precipitator to eliminate the necessity for manual monitoring of the units.

Induced Draft Fan

An induced draft fan is located on the discharge side of the precipitator to draw flue gas from the incineration system and discharge it under pressure into the scrubber and stack. The fan is designed to maintain a slightly negative pressure in the secondary combustion chamber to prevent gas from escaping before it is completely burned out, cooled and cleaned. Locating the fan between the precipitator and scrubber allows the fan to operate on dry gas with low dust loading which extends fan life expectancy and minimizes maintenance requirements. An automatically controlled damper is installed at the fan inlet to control pressure in the secondary combustion chamber.

The operating energy requirement of the fan is approximately 360 kW (448 kW connected). The fan drive includes a two speed motor with the second (low) speed connected to the emergency power system to allow movement of a minimum quantity of flue gas in the event of a power failure.

The fan wheel and housing are constructed of carbon steel. The wheel is of radial tip design, statically and dynamically balanced. A high mass, inertia base frame with vibration isolation pads is provided to absorb and dampen vibration.

Wet Scrubbing System

The flue gas discharge from the induced draft fan is cooled to protect the scrubbing equipment in the first stage (quench) of a three stage wet scrubbing system.

In the quench, the hot flue gas is cooled from 160°C to its saturation temperature of approximately 60°C using liquor from its own recycle sump located in the bottom of the scrubber. The quench is equipped with a sweep elbow to allow the excess water to flow into the sump located in the scrubber.

The quench is a fixed throat, round spray design with scrubber water injected through spray nozzles mounted around the top of the quench section. The quench is fabricated of carbon steel plate and lined with a corrosion resistant castable refractory. Piping, nozzles and flanges are fabricated of corrosion resistant alloy.

A two stage scrubbing tower is provided to remove hydrogen chloride (HCl), hydrogen fluoride (HF) and sulphur dioxide (SO_2). The tower comprises stages two and three of the three stage scrubbing system. The flue gas enters the bottom of the tower and flows through a chevron mist eliminator before passing upward through a packed bed section (stage two) counter to the flow of scrubbing liquor. Scrubbing liquor is uniformly distributed over the top of the packing through low pressure, nonclogging spray nozzles. Mist eliminators located over the spray manifolds prevent liquid carry-over to the next stage.

HCl and HF are removed in the packed bed section where absorption is maximized by the large surface area of the packing material. The scrubber liquor is collected in the sump underneath the packed bed and recycled to the spray nozzles. A minimum liquor level in the sump is maintained automatically through the addition of make-up water. The HCl and HF concentrations are maintained by bleeding off scrubber liquor, which is used as make-up to the quench sump. Bleed-off from the quench sump is neutralized by the addition of a 25% solution of calcium hydroxide from reagents storage and handling (p. 77) before being pumped to the spray dryer.

SO_2 is removed in the third stage of the scrubbing tower. A procedure similar to the one described in the HCl and HF removal section is used, with the exception that multiple small venturis (Ring Jets™ see Footnote 1.) are used instead of the packed bed. A sodium hydroxide solution is used as the scrubbing liquor to prevent the formation of calcium sulfate, which would lead to scaling problems in the scrubber. Once the scrubber liquor has passed through the Ring Jets™, it is collected and drained out of the tower into a separate sump, and recycled. Bleed-off from this sump maintains a constant concentration of sodium sulfite and sulfate, as dissolved solids, and is used as the make-up for the stage two sump. The liquor level in this sump is maintained automatically with the addition of make-up water to the scrubber. The pH of the scrubber liquor is controlled automatically at a value of approximately 6.5 with the addition of 50% solution of sodium hydroxide, from the reagent storage and handling systems (p. 77).

The Ring Jets™ also remove residual fine particulates (such as heavy metals) from the flue gas using agglomeration and impaction forces to collect and entrain the fine particulates in the recirculated scrubber liquor.

The scrubbing tower and recycle tanks are fabricated of carbon steel plate with rubber lining. Piping, packing, nozzles and mist eliminators are constructed of FRP or polypropylene.

Separate pump manifolds are provided to recycle scrubber liquor in each stage of the scrubber. Each manifold includes two pumps (one running, one stand-by) with the required valves and drains.

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1. Ring Jet™ is a trademark of Ciba-Geigy Ltd., Basel, Switzerland.

Maintenance of liquid levels in the combined quench and scrubber sump requires replacement of liquor lost as blowdown from the quench's sump and that evaporated in cooling the flue gas. This replacement is achieved by spraying clean make-up water onto the mist eliminators, located after each scrubbing stage, to remove any deposits that have collected on them. The water then falls from the mist eliminators into the scrubber section below.

3.3.2.4 Flue Gas Reheating

The flue gas leaving the gas cleaning equipment is reheated prior to being discharged up the stack resulting in:

- elimination of visible steam plume from the stack except during cold weather conditions,
- improved bouyancy of the plume, which is of particular benefit during adverse atmospheric conditions,
- reduced corrosion of flues, and
- easier monitoring of the "dry" flue gas.

The plume suppression system consists of a jacketed steam to air heat exchanger, using steam to reheat the flue gas to a temperature of 130°C.

3.3.2.5 Stack

A 60 m high stack is provided to discharge treated flue gases to atmosphere. A stack liner of approximately 1.3 m in diameter maintains a flue gas exit velocity of approximately 20 m/s when the incineration system is operating at full capacity. The stack is designed to accommodate the addition of a second stack liner, should a second incineration system be installed at some future date. The stack includes mountings for all monitoring equipment, as well as platforms and ladders for both sampling and maintenance.

3.3.2.6 Residue Handling Systems

Two distinctly different residues have to be disposed of from the incineration plant, namely:

- slag from the rotary kiln, and
- boiler ash and salt and flyash from the flue gas treatment system.

Slag and Ash Quench System

An automatic system is provided to continuously remove slag and flyash from the combustion components of the incineration system. The system is located under the secondary combustion chamber and includes a quench tank and a steel belt conveyor. Non-combustible residues from the kiln and secondary combustion chamber drop into the quench tank and are conveyed to a drop box type portable container. The water level in the quench tank is maintained automatically by a float valve. The residues from a high temperature rotary kiln incineration system typically exhibit an excellent self draining characteristic, and dewatering beyond draining on the inclined portion of the conveyor is not required.

The discharge chute of the secondary combustion chamber extends into the quench tank, below the water level, thus ensuring an air tight seal. The slag conveyor runs along the bottom of this tank, up a thirty degree angle and dumps into a disposal container. The tank is fabricated from carbon steel, with wear strips under the steel belt conveyor. The chain, flights, and sprockets are all manufactured from hardened steel.

The drop box portable container when full, is transported to the engineered landfill where the slag is disposed of (p. 160).

Boiler Ash Salt and Flyash System

Boiler ash is discharged from the three ash hoppers of the heat recovery boiler, through double dump valves to the boiler ash conveyor. This conveyor, which runs from the hoppers to the ash and salt conveyor, is a drag chain type, enclosed in a dust tight enclosure which is insulated and heat traced to prevent corrosion and cementation. The chain and flights are made from hardened steel, with abrasion resistant liners under their path.

Salt formed in the spray dryer and flyash collected in the precipitator are discharged from their respective hoppers through double slide gate valves to an enclosed chain conveyor with construction similar to that of the boiler ash conveyor. A bucket elevator transfers the salt and flyash to a second conveyor which discharges into the dedicated solidification system, located within the incineration plant.

The salt and ash conveyor, discharges the boiler ash, salt and flyash into the dedicated solidification system located at the incineration plant.

This dedicated solidification system is similar to the high solids treatment system described later, (p. 148) consisting of two mixers. Residue solids from the incineration plant are fed to either solidification mixer by a conveyor on a continuous basis. When the residue capacity of the mixer is reached, the residue is diverted to the other mixer. Portland cement, stored in a silo at the incineration plant, is transferred pneumatically to the mixer, in the same way as at the solidification plant, in the correct proportion as determined by formulation. Process water and lime, available at the incineration plant, is added as determined by the formulation. Provision for storing and adding other minor additives is provided. The mixer discharges to the product discharge conveyor which transports the solidified material to a dumpster for transport to the engineered landfill.

3.3.2.7 Reagent Storage and Handling Systems

Reagents are required to be stored and handled for use in the following areas:

- flue gas treatment system, and
- dedicated solidification system.

Flue Gas Treatment System

The flue gas treatment system uses two different reagents as part of the wet scrubbing system; one calcium hydroxide (lime) system to neutralize the scrubber blow down prior to injection into the spray dryer and the other a sodium hydroxide (caustic) system to control the pH of the scrubber liquor.

Calcium Hydroxide (Lime) System. Hydrated lime ($Ca(OH)_2$) is received in bulk by truck and stored in a lime silo located in the flue gas treatment building. The lime is mixed with water in the lime slurry tank to make a slurry of 25% lime by weight for neutralizing the scrubber blowdown prior to being treated in the spray dryer.

Sodium Hydroxide (Caustic) System. A 50% solution of caustic is received in bulk by tank truck and stored in the caustic soda tank. The caustic soda tank is constructed of carbon steel, heated and insulated and caustic soda is fed to the scrubber system using one of two 100% caustic soda feed pumps.

Dedicated Solidification System

Portland cement is received in bulk by truck which discharges to the cement silo pneumatically using the blower mounted on the truck.

Lime, if required, will be utilized from the lime silo of the flue gas treatment system.

3.3.2.8 Auxiliary Systems

Auxiliary systems comprise the systems required to operate the waste heat recovery boiler of the flue gas cooling system namely:

- steam system,
- boiler feedwater and condensate system, and
- boiler chemical dosing system.

Steam System

The steam system distributes steam, generated in the waste heat recovery boiler, through a medium pressure header at 2750 kPa/300°C and a low pressure header at 450 kPa and 10°C superheat to supply process heat, mechanical services, and heating, ventilating and air conditioning (HVAC) within the Facility.

The final operating pressure(s) and temperature(s) will be established during detailed design on completion of studies and evaluation of the overall steam system.

Two packaged, water tube, gas fired auxiliary boilers are provided for steam generation to the medium pressure header when the waste heat recovery boiler is not available and to supplement the waste heat recovery boiler's output when required. The preliminary sizing of the auxiliary boilers is 30 t/h each.

Medium pressure steam is used:

- to power the steam turbine driven boiler feed pumps (p. 82),
- to heat the flue gas in the flue gas reheater (p. 75), and
- as atomizing steam in the liquid waste and sludge lances (p. 59).

The low pressure steam header receives steam from the exhausts of the boiler feed pump drivers and also through a pressure reducing and desuperheating station from the high pressure header.

Low pressure steam is used:

- to preheat the primary combustion air of the rotary kiln (p. 61),
- for heating and air conditioning various buildings within the Facility,
- for heating drums in the organic drum storage and handling building (p. 190),

- for heating aqueous organic waste at the emulsion breaking tanks of the aqueous organic waste treatment system (p. 115),
- for tank heating in the incinerator tank farm (p. 168),
- for evaporation of excess treated effluent at the physical/chemical treatment plant (p. 113),
- in the deaerator of the boiler feedwater system (p. 81), and
- at various plant utility stations.

During times of the year when steam generated by the waste heat recovery boiler is in excess of that required within the Facility, the surplus steam is condensed in two 50% duty, forced draft, air cooled, dump condensers mounted on the boiler house roof.

Boiler Feedwater and Condensate System

With the exception of the steam used for atomization in the rotary kiln liquid waste and sludge lances and steam used at plant utility stations, all condensate is collected in one of two systems, namely:

- clean condensate system, and
- potentially contaminated condensate system.

The clean condensate system receives clean condensate from the dump condensers, building heating and air conditioning systems, flue gas reheater and primary combustion air heating system. Condensate is collected in the clean condensate tank and returned to the deaerator via one of two 100% clean condensate transfer pumps.

The potentially contaminated condensate system receives condensate which could potentially have been contaminated by the leakage of heat exchangers in their respective service. Potentially contaminated condensate is collected in one of two potentially contaminated condensate tanks which can be isolated in the event that serious contamination is detected. Continuous condensate quality monitors are located in individual condensate lines from major condensate sources. Contaminated condensate is discharged to the physical/chemical treatment plant for treatment.

The clean and potentially contaminated condensate systems do not collect all the condensate for returning to the deaerator. Make-up water from the demineralization trains is required to replace steam/ condensate lost from the system as follows:

- unrecoverable steam (atomization and utility stations),
- steam distribution losses,
- boiler blowdown, and
- an allowance for replacement of contaminated condensate.

Two 100% demineralization trains are provided to produce the necessary high quality make-up water required by the waste heat recovery and auxiliary boilers and transfer the demineralized make-up water to the deaerator via one of two 100% demineralized water transfer pumps. Each demineralization train consists of a strong acid cation unit and a strong base anion unit. Water is pumped from the treated water storage basin in the raw water treatment plant (p. 203), through the anion and cation units of one train into the demineralized water storage tank. The system is controlled by the level in the demineralized water storage tank and one train remains on standby while the other is in service.

When the ion exchange units are exhausted they are regenerated by adding sulphuric acid to the cation unit and sodium hydroxide (caustic) to the anion unit. The regenerant liquids are collected and sent to the physical/chemical treatment plant for treatment. The regeneration sequence is automatically controlled by preset logic.

Demineralized water is pumped from the demineralized water storage tank to the deaerator as required by the level in the deaerator storage tank.

An open type deaerating heater is provided to preheat and remove dissolved oxygen and non-condensible gases from the boiler feedwater. The heated and deaerated water is stored in the deaerator's integral storage tank. The volume of feedwater stored in the deaerator storage tank is controlled by preferential make-up from the condensate system as follows:

- first from the clean condensate tank,
- second from the potentially contaminated condensate tanks, and
- third from the demineralized water storage tank.

Feedwater is drawn from the deaerator storage tank and pumped to the waste heat recovery boiler and auxiliary boilers via boiler feed pumps. Three 50% multistage centrifugal pumps are used with one electric motor driven pump used for start-up and emergency back up duties and two steam turbine driven pumps used for normal operation.

Boiler Chemical Dosing System

A chemical dosing system is provided for direct chemical treatment of boiler feedwater:

- to prevent boiler scaling caused by hardness constituents,
- to provide pH control to prevent corrosion, and
- to control oxygen to guard against its attack on equipment.

While most dissolved oxygen is expelled in the deaerating heater, as a further assurance against attack by dissolved oxygen, a residual quantity of an oxygen scavenging compound is maintained in the feedwater. With the proposed boiler operating pressure, sodium sulphite is the most common scavenger used. It is injected into the storage tank of the deaerating heater.

Along with sodium sulphite, morpholine is also injected into the deaerator storage tank. This chemical is used to control the pH of both feedwater and returning condensate to control corrosion in these systems and in the boilers.

Trisodium phosphate is injected into the boilers' steam drums to precipitate the hardness constituents from the boiler water. The precipitates are then removed from the boilers in the continuous blowdown.

The equipment is skid mounted and consists of three stainless steel tanks (one for each chemical), a phosphate mixing agitator and three pairs of metering pumps (one operating, one spare) for injecting the chemicals. The three chemicals are added to their respective mixing tanks manually through dust-tight covers. Demineralized water is piped to the mixing tanks to form the solutions to be injected.

The phosphate mixing pumps have an adjustable stroke which is varied manually in accordance with results from analysis of the boilers' blowdowns. The output of the sodium sulphite and morpholine pumps is varied automatically in accordance with the output from a controller located in the steam and water sampling package. Both sets of pumps are also provided with the ability to be manually controlled or adjusted.

3.3.2.9 Control Centre and Offices

The incineration building houses the incinerator control centre and offices and facilities for the operations staff associated with the incineration plant.

Control Centre

The incinerator control centre is the principal control centre for the Facility, as it will be manned continuously 7 days/week and consists of the following:

- A control room containing the control consoles and panels housing all the operator interface facilities including television monitors (CRT's), keyboards, printers, annunciators and back-up instrumentation.

- An equipment room containing all the field cable terminations and processing equipment associated with the process control system.

- A storage room for records and consumable items.

- A room designated for support equiment, furnished and equipped as a clean area for carrying out minor maintenance to the process control system electronic equipment.

Operators in the incinerator control room have responsibility for the following areas:

- incinerator and flue gas treatment systems,
- steam and condensate systems,
- incinerator tank farm,
- utility systems (air, nitrogen, water, natural gas),
- fire pumps,
- plant-wide safety systems (fire, gas detection, etc.),
- selected critical alarms and process parameters from organic waste storage and handling areas, and
- selected critical alarms and process parameters from the physical/ chemical treatment plant.

The control console in the control room houses the following functions for the above areas:

- process control,
- plant status monitoring,
- plant safety and emergency systems monitoring,
- hazard annunciation, and
- data management.

In addition, the incinerator control room will house the crane operator's console.

Offices

Offices and facilities (such as lunch room, locker room, showers and toilets) are provided for the supervisory and operating personnel associated with the incineration plant.

3.3.2.10 Mechanical and Electrical Rooms

Provision has been included in the incineration building to accommodate mechanical and electrical rooms to house equipment necessary for servicing the incineration plant and also some of the general utility services.

Mechanical Room

There are two areas in the incineration building allocated to house mechanical equipment as follows:

- A penthouse above the control centre for HVAC equipment associated with the incineration building.
- An area on the ground floor for utility equipment, (such as compressed air system and heat recovery equipment).

The HVAC equipment supplies four main levels of service as follows:

- air conditioning,
- heating and cooling,
- heating and ventilation, and
- general extract.

The functional requirements of each level of service will provide for the:

- adequate comfort for occupants, and
- suitable environment for equipment.

This is achieved by controlling temperature, humidity, air movement, noise level and air purity as required using proven HVAC systems.

Electrical Room

The electrical room houses the switchgear and motor control centres and other electrical equipment associated with the incineration plant, organic drum storage and handling building and incinerator tank farm.

3.3.3 NORMAL OPERATION

The following outlines the incineration plant operating philosophies and safety features which ensure that the plant performs as expected and is capable of operating in a safe, environmentally sound manner.

3.3.3.1 General

Figure 3.12 provides a schematic overview of the operating philosophy of the incineration plant. The key operating features of the incineration plant are summarized below:

- The incineration plant will operate continuously, 24 hours per day, 7 days a week.

- The plant is expected to operate 7000 hours per year with the remaining time being available for planned and unplanned outages for maintenance. At least one major planned shutdown for maintenance and repairs to refractory structures will be scheduled annually.

- Aqueous organic waste will, wherever possible, be treated by physical/chemical methods to remove water, with the concentrated organic residue being returned to the incinerator (organic) tank farm for storage, in readiness for incineration.

- Other residues from the physical/chemical treatment plant which are unsuitable for solidification due to their organic content, will be incinerated. These may still have relatively low organic content and are shown on Figure 3.12 as dilute organic residues.

- Daily menus will be prepared for the incineration plant, identifying the types of wastes to be incinerated, feed rates, sequences, and required blending. It should be noted that:

    - Some waste types such as aqueous organics and contaminated water may be pumped directly from the storage tank to the incinerator.

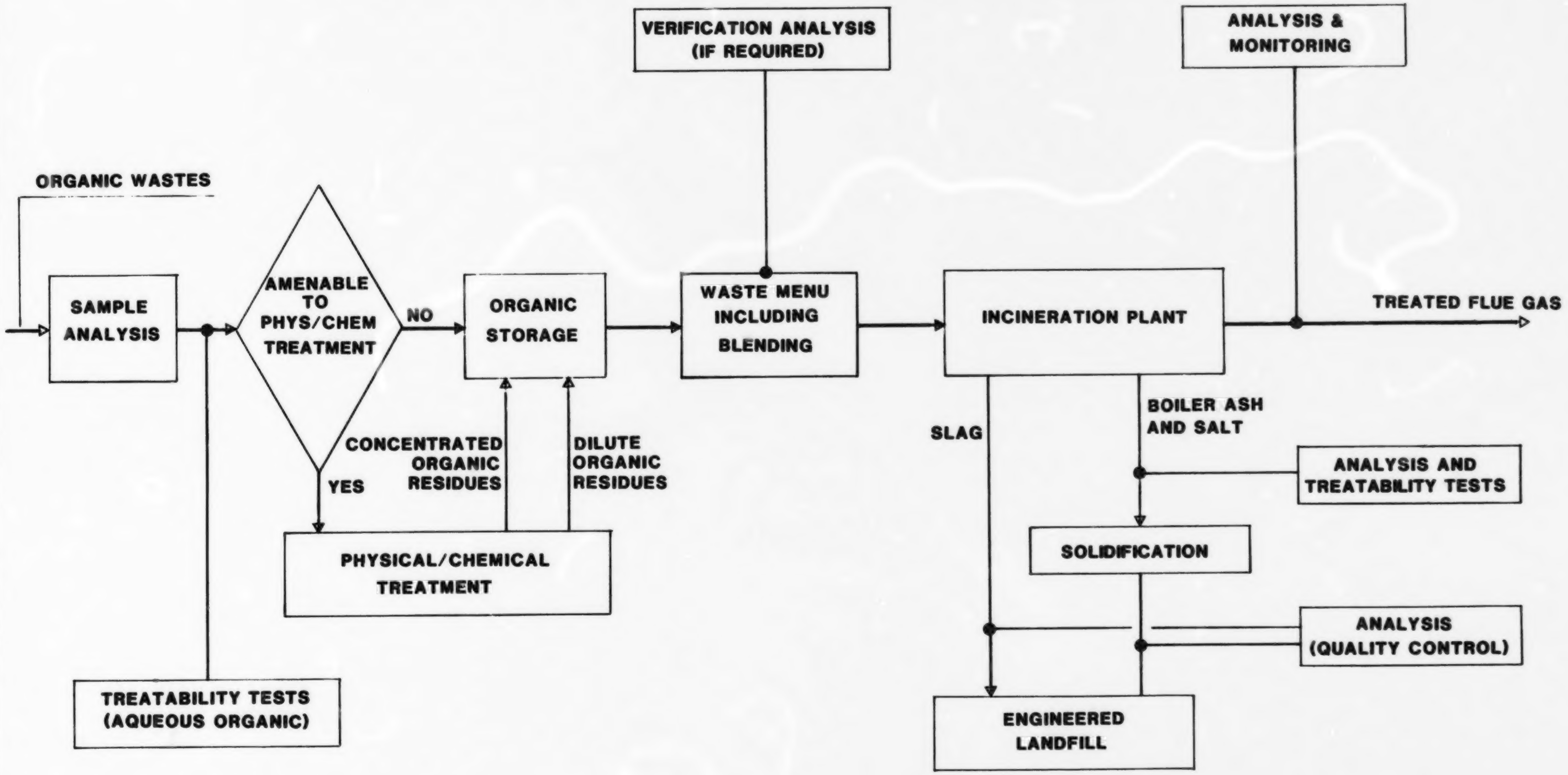

ORGANIC WASTES
SAMPLE ANALYSIS
AMENABLE TO PHYS/CHEM TREATMENT
NO
YES
ORGANIC STORAGE
CONCENTRATED ORGANIC RESIDUES
DILUTE ORGANIC RESIDUES
PHYSICAL/CHEMICAL TREATMENT
TREATABILITY TESTS (AQUEOUS ORGANIC)
VERIFICATION ANALYSIS (IF REQUIRED)
WASTE MENU INCLUDING BLENDING
INCINERATION PLANT
ANALYSIS & MONITORING
TREATED FLUE GAS
SLAG
BOILER ASH AND SALT
ANALYSIS AND TREATABILITY TESTS
SOLIDIFICATION
ANALYSIS (QUALITY CONTROL)
ENGINEERED LANDFILL

FIGURE 3.12
INCINERATION PLANT
OPERATING PHILOSOPHY
SCHEMATIC

  - Segregated organic wastes such as PCBs will preferably be transferred directly from the storage tank to the rotary kiln.

  - Sludges will be blended in the blending tanks located in the incinerator tank farm.

  - The remaining organic liquids such as waste oils and solvents, which are used for combustion control purposes, will be mixed in blending tanks located in the incinerator tank farm.

  - The sequence and feed rate of drums will be predetermined as part of the daily menu.

  - The type, sequence and charge rate for bulk solids from the waste pits will be predetermined as part of the daily menu.

- Additional analyses of blended wastes may be obtained in order to verify that important parameters such as heating value, chlorine and sulphur content are within prescribed limits. This will be a check analysis, since storage tank contents will have been previously characterized from analyses conducted on samples prior to delivery and verified by "fingerprint" analysis at the time of delivery (p. 32).

- Documentation will be provided to operators giving instructions on procedures which must be observed during the handling and treatment of wastes including emergency procedures which must be followed in the event of spillage.

- The measures described in the previous three paragraphs will enable rigid control to be maintained over the nature of waste fed to the incinerator.

- The concentration of the following stack gas contaminants will be monitored, to ensure optimum operation of the incineration system:

- carbon monoxide (CO),
- sulphur dioxide (SO_2),
- nitrogen oxides (NO_x),
- hydrogen chloride (HCl), and
- total hydrocarbons (THC).

(Note: Organic carbon content will be determined by the flame ionization detection method. Under US Environmental Protection Agency regulations, this organic carbon content is expressed as a methane equivalent to indicate total hydrocarbon content of the flue gas.)

In addition, periodic stack sampling will be conducted for selected contaminants which cannot be continuously monitored eg. heavy metals.

- Samples of boiler ash and salt (residue) from the incineration plant will be taken periodically for analysis and solidification treatability tests to ensure that the optimum formulation is being used. The relative consistency of this residue stream will permit batches of these materials to be solidified as they are received from the incineration process without waiting for the results of specific treatability tests on each sample. This would in any case be impractical due to the time required.

- Samples of slag will be taken for analysis for record purposes.

3.3.3.2 Operational Safety

Process Safety Features

This section identifies the main safety features that are incorporated in the design to minimize risk to human health and environmental impacts.

Waste Feed Cut-Off. Complete or partial waste feed to the incineration system is cut off automatically should any of the following events occur:

- High carbon monoxide or high total hydrocarbon content in the treated flue gas.
- Low temperature in the secondary combustion chamber.
- Low primary and/or secondary air flow.
- Sustained abnormal pressure in the secondary combustion chamber.
- High steam pressure in the boiler drum.
- Failure of two precipitator fields.
- High temperature in the secondary combustion chamber.
- Low water level in the waste heat recovery boiler.
- Malfunction of the induced draft fan.
- Failure of two out of three thermocouples located after secondary air injection in the secondary combustion chamber.
- Interruption of quench or scrubber water circulation.
- Power failure.

Waste Feed Interruption. An unexpected interruption of waste feed will be detected by a loss of temperature in the secondary combustion chamber, unexpected operation of the auxiliary fuel burner in the side wall of the secondary combustion chamber and a significant increase in the oxygen concentration level in the flue gas. In this situation, there is no risk of imminent harm to human health or the environment and no special or unusual action is required. The burners in the front wall of the kiln and in the secondary combustion chamber will be utilized, as required, to maintain required temperatures while the situation is rectified.

Loss of Auxiliary Fuel (Natural Gas). An interruption in the natural gas supply to the burners in the front wall of the kiln and in the secondary combustion chamber will be detected by a loss of pressure in the fuel line. Should this situation occur during start-up or shutdown procedures, there will be no risk of imminent harm to human health or the environment and no special or unusual action will be required since in the first instance, waste will not have been introduced to the system, while in the second instance, the destruction of waste should have been completed. Should this situation occur during normal operation of the incineration system when operation of the burners is required to maintain temperature in the secondary combustion chamber, then all waste feed will be suspended until normal operating conditions can be established and maintained.

Combustion Temperature Limits. Temperatures in the combustion system will be measured by temperature sensors located in the secondary combustion chamber. Organic waste cannot be introduced to the incinerator unless the flue gas temperature before secondary air addition is above 1050°C, aqueous waste cannot be introduced unless the temperature is above 1100°C, and segregated organic wastes such as PCBs cannot be introduced unless the gas temperature prior to secondary air addition is above 1250°C. Control interlocks will prevent waste being introduced unless these temperature conditions are satisfied.

Conversely, the feeding of segregated organic wastes will be automatically shut off should the flue gas temperature prior to secondary air addition fall below 1200°C, aqueous waste feed will be shut off should the flue gas temperature fall below 1050°C, and organic waste feed will be shut off if this temperature falls below 1000°C.

It should be noted that these are safety interlocks and the normal operating temperatures prior to and after secondary air addition will be approximately 1200°C and 950°C respectively. The operator will have ample warning and time for corrective measures should these temperatures start to fall, and thereby avoid the initiation of safety interlock features.

Nevertheless, should the flue gas temperature before secondary air injection drop below 1050°C, all aqueous waste feed will be stopped automatically in an attempt to prevent a further decrease. Should the temperature continue to drop, one of the auxiliary fuel burners in the secondary combustion chamber will start-up automatically when the temperature reaches 1030°C. If this does not remedy the situation, all waste feed will automatically be cut off when the temperature drops below 1000°C.

Segregated organic wastes such as PCBs can only be fed to the rotary kiln when the kiln front wall burner is operating, thereby providing additional assurance that high destruction efficiencies will be achieved and discharges to the environment minimized.

Abnormal Level of Excess Air in the Combustion System. The level of excess air in the combustion zone is monitored by measuring the concentration of oxygen in the flue gas. Moderate fluctuations in the oxygen level are normal, however significant, sustained deviation from the established level indicates a malfunction.

Heat input by the organic liquid lance will be controlled by the oxygen level in the flue gas in normal operation. However, if the oxygen content drops below or rises above a predetermined acceptable operating range, then control of heat input by this lance is automatically switched to temperature control based on temperature in the secondary combustion chamber.

A drop in the concentration of oxygen in the flue gas indicates excessive waste feed (heat release) or a malfunction of the primary or secondary combustion air systems. In either case, a decline in the concentration of oxygen will result in an increase in the temperature in the secondary combustion chamber.

The control system responds automatically to falling oxygen concentration or increasing temperature by first reducing the high heating value liquid waste feed rate. On a continued decline in oxygen concentration or a continued increase in temperature, or in the event of detection of a malfunction of either the primary or secondary combustion air systems, an alarm will sound followed by suspension of all waste feed to the system.

Conversely, an increase in the concentration of oxygen in the flue gas indicates inadequate waste feed (heat release) or an increase in the amount of combustion air. In either case, an increase in the concentration of oxygen will result in a decline in the temperature in the secondary combustion chamber.

The control system responds automatically to increasing oxygen or decreasing temperature by first increasing the high heating value liquid waste feed rate. On a continued decrease in temperature, an alarm sounds followed by automatic ignition of one of the auxiliary fuel burners in the secondary combustion chamber. Further decline in temperature, or in the event of an excess amount of combustion air or if a burner flame-out condition is detected, will result in a second alarm being sounded followed by suspension of all waste feed to the system.

Abnormal Pressure in the Secondary Combustion Chamber. A sustained positive pressure in the secondary combustion chamber is indicative of excessive waste feed, malfunction of the induced draft fan or a blockage somewhere in the path of the flue gas as it flows through the system. In any case, waste feed is suspended if the positive pressure continues for more than a few seconds. A sustained excessively negative pressure is indicative of insufficient waste feed or of a malfunction of the primary air fan, secondary air fan or induced draft fan. Here too, waste feed would be suspended.

Malfunction of the Primary or Secondary Combustion Air Fans. A malfunction of the primary or secondary air fans will be detected by measuring air flow at the fan discharge. Loss of air flow from either the primary or secondary combustion air fans will result in immediate suspension of all waste feed and initiation of a controlled shutdown of the system. One of the burners in the side walls of the secondary combustion chamber will be utilized, as required, to maintain temperatures in the combustion zone until destruction of the waste is complete.

Water Level in the Boiler Too Low. The water level in the waste heat recovery boiler is monitored by observing the level of water in the steam drum. In normal operation, water level in the boiler drum is controlled automatically by a three element controller. Low water level is indicative of a malfunction of the boiler feed water system or a major leak in the boiler. In either case, immediate suspension of waste feed and a controlled shutdown of the system is initiated.

Temperature in the Spray Dryer Too High. The flue gas temperature in the spray dryer is monitored by temperature sensors located at the entrance and exit of the dryer. High entrance temperature is indicative of a malfunction of the flue gas cooling system or heavy fouling of the boiler, whereas high exit temperature from the spray dryer may indicate a malfunction in the spray dryer feed system. High temperature of the flue gas leaving the spray dryer automatically initiates operation of the emergency water system and an alarm. If the condition persists, all waste feed will be suspended and a controlled shut-down initiated by operations staff. Low entrance temperature may cause operational difficulties since the flue gas may not have sufficient heat to evaporate the required quantity of scrubber effluent. However, this condition can only occur during start-up and shut-down of the incineration plant. Operations staff will be trained when and how to start introduction of neutralized scrubber blowdown or water to the spray dryer. Additionally, the operating manual will detail the necessary steps and conditions.

Loss of Power to the Electrostatic Precipitator. The electrostatic precipitator has three electrical fields. Power to the fields is monitored with voltmeters on the electrical feed, and a loss of power to the fields results in an immediate suspension of waste feed and a controlled shutdown of the system.

Malfunction of the Induced Draft Fan. A malfunction of the induced draft fan will be detected by an increase of pressure in the secondary combustion chamber, an unexpected reduction in fan speed, or an unexpected loss of electrical power to the induced draft fan motor. A malfunction of the induced draft fan results in immediate suspension of all waste feed. The primary and secondary combustion air fans are then turned off.

It should be noted that the induced draft fan has an auxiliary motor drive which can continue to operate the fan during power interruption, as further described under "power failure".

Interruption of Quench or Scrubber Water Circulation. A loss of quench or scrubber water circulation is detected by a variety of indicators including loss of water pressure, loss of scrubber liquor flow, loss of electrical power to one or more of the circulation pumps as detected by auxiliary contacts on the pump motor starters, high temperature of the flue gas leaving the quench section or loss of fluid level in the scrubber liquor sumps. All quench and scrubber circulation pumps are spared and failure of the operating pump initiates the automatic starting of its spare, except in the instance of a general power failure, which causes all waste feed to be stopped and a system shutdown initiated. High temperature of the flue gas leaving the quench section automatically initiates operation of the emergency water system and an alarm.

Ventilation

The following features are included to minimize risk to human health and discharges to the environment:

- The waste storage pit area is ventilated to the rotary kiln by the primary air fan or to atmosphere using roof mounted ventilation fans when the kiln is not operating.

- The kiln-front area including drum conveyor area is well ventilated to prevent the buildup of organics. Drums are covered with a loosely placed top or plastic cover.

- The control room is ventilated and air conditioned.

- The rotary kiln including end seals is located in an isolated room with controlled access for personnel protection. The room is vented to atmosphere via roof vents.

- The incinerator building enclosing the secondary combustion chamber, waste heat recovery boiler and auxiliary equipment is ventilated in accordance with normal industry practice. No contaminant control measures are required in this area.

- All other buildings are ventilated in accordance with normal industry practice.

3.3.4 ABNORMAL OPERATION OR UPSET CONDITION

The following outlines the incineration plant operating philosphies, safety features and emergency procedures of the process design which are aimed at containing and minimizing the effects resulting from abnormal operation or upset conditions.

3.3.4.1 Spills and Leaks

- Accidental spills of organic wastes or other process fluids (eg. scrubber water) will be contained by provision of curbing and sumps. Spills will be isolated and cleaned up using predetermined safety procedures.

- Ash or salt spills will similarily be isolated, cleaned up and the material disposed of on-site. Particular attention will be given to good housekeeping in the residue handling areas.

3.3.4.2 Power Failure

The potential for emission of contaminants to the environment during a power failure will be minimized by the following design features and operational sequences.

- Plant control and status monitoring systems are connected to an uninterruptible power supply (battery system) so that such systems remain in operation throughout a power failure event.

- When burning non-liquid waste contaminated with PCBs, the secondary combustion chamber burner (used to maintain temperature in the secondary chamber) will be placed in operation. The normal power supply to those items of equipment necessary to keep the burner in operation is supplemented by an alternate power supply arranged to ensure that the burner remains operational during a power failure. The burner automatically modulates to the high fire position upon power failure, thereby providing additional assurance that organics volatilized in the rotary kiln will continue to be destroyed.

- Waste feed to the incineration system is automatically terminated upon power failure.

- The emergency electrical power system will be initiated and electrical power will be provided to critical items of equipment within thirty seconds (p. 218).

- During the intervening period:
  - the induced draft fan will gradually slow down but continue to draw flue gas through the system, preventing the egress of gases through kiln seals, feed chute, boiler seals and other potential sources at the working level,

  - temperatures in the combustion system will begin to fall, but remain above values which will destroy residual organic contaminants in the system,

  - visible combustion (flame) in the kiln will be substantially reduced, although the residual heat, together with air drawn into the system by the induced draft fan, will be sufficient to complete combustion of any material in the kiln.

  - the waste heat recovery boiler will continue to cool flue gases, and thereby generate steam, and boiler feedwater supply will be uninterrupted since the steam turbine driven feed pumps will continue to operate,

  - the flue gas temperature from the boiler will drop immediately due to the reduced flue gas flow,

  - flue gases passing through the spray dryer and electrostatic precipitator at higher than normal temperatures will not cause any harm, since both units are designed to withstand temperatures of up to 425°C,

- quench water will continue to be provided to the first stage of the wet scrubber from head tanks, located in the stack, which are sized to provide up to 15 minutes of water supply,

- flue gases will continue to be partially treated in the wet scrubber by the removal of acid gases and particulates in the quench section and also the residual water in the packed tower, albeit at a reduced efficiency, and

- flue gases will continue to be discharged to atmosphere via the stack at reduced volumes.

- When the emergency power system is operational, within thirty seconds of power failure, the following equipment will start or restart automatically:

  - Induced draft fan auxiliary drive will operate the fan at reduced speed, to maintain the flow of residual flue gases and prevent egress of gases to atmosphere in the operating areas.

  - Wet scrubber circulating water pumps will restart, thereby reinstating the scrubber at full operational efficiency.

  - Rotary kiln drive motor.

  - Equipment cooling systems.

  - Electrically driven boiler feed pump and associated feedwater transfer and condensate pumps.

  - Required auxiliary systems.

- The rotary kiln can continue to be shutdown under controlled conditions, or it can be restarted once normal power has been restored to the plant.

3.3.4.3 Fire

A complete fire prevention and control system is provided and designated staff will be trained in fire fighting methods.

Specific features of interest in the incineration plant are as follows:

- Firewater standpipes and hose cabinets are located in the incinerator and auxiliary equipment areas.
- The control room is protected by a "Halon" gas fire extinguishing system.
- Local deluge water systems are provided in the waste pit area.
- A foam fire protection system is provided over the rotary kiln bulk waste feed chute.
- A foam deluge water spray fire protection system is provided over the drum conveyor from the drum handling building to the kiln feed chute.

3.3.4.4 Emergency Provisions

- Escape routes are provided from all areas of the incineration plant for use in the event of a major fire. At least two alternative escape routes are provided from elevated floors inside buildings.
- Emergency eyewash and shower stations are provided at strategic locations in the incineration plant, notably where reagents/chemicals are being prepared and handled.

3.4 PHYSICAL/CHEMICAL TREATMENT PLANT

The physical/chemical treatment plant comprises three treatment systems for treating incoming inorganic wastes and on-site generated wastes such as contaminated surface drainage and leachate.

This section describes the physical/chemical treatment plant (shown on Figure 3.2) as follows:

- waste storage and handling, and
- physical/chemical treatment plant.

Figure 3.13 provides a pictorial flow diagram of the three treatment systems in the physical/chemical treatment plant and illustrates the main components.

Figures 3.14 to 3.17 provide the conceptual equipment layouts, in both plan and sectional views, of the physical/chemical treatment plant.

3.4.1 WASTE STORAGE AND HANDLING

Inorganic wastes are fed to the physical/chemical treatment plant from the physical/chemical storage tank area. The unloading and storage of these inorganic special wastes is described in Sections 3.2.2.2 (p. 39) and 3.7.3.2. (p. 177).

3.4.2 PHYSICAL/CHEMICAL TREATMENT PLANT

The physical/chemical treatment plant accommodates the following:

- inorganic waste treatment system,
- aqueous organic waste treatment system,
- miscellaneous waste treatment system,
- reagent storage and feeding system,
- control centre, laboratory and offices, and
- mechanical and electrical rooms.

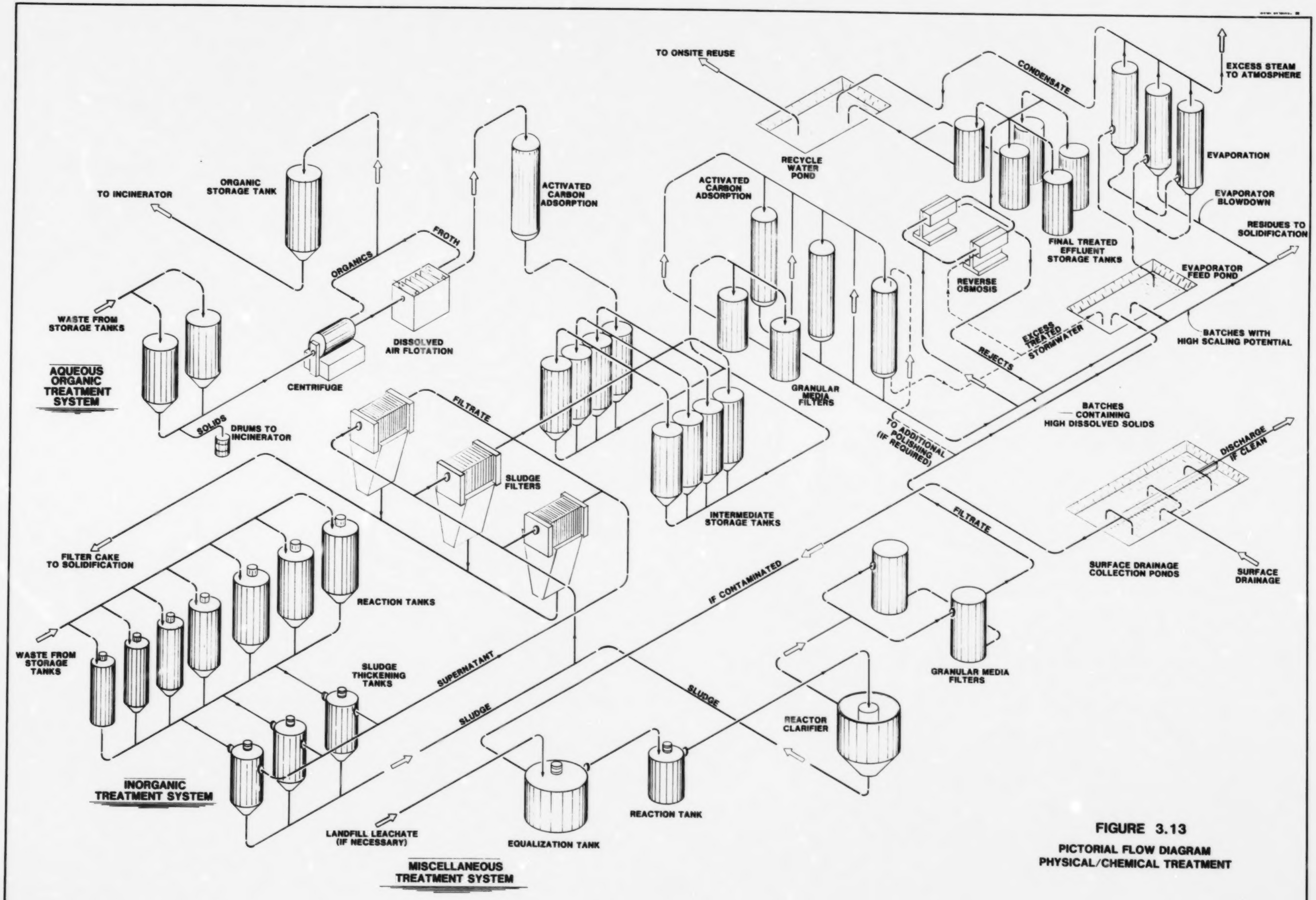

TO ONSITE REUSE
CONDENSATE
EXCESS STEAM TO ATMOSPHERE
TO INCINERATOR
ORGANIC STORAGE TANK
ACTIVATED CARBON ADSORPTION
RECYCLE WATER POND
ACTIVATED CARBON ADSORPTION
EVAPORATION
EVAPORATOR BLOWDOWN
RESIDUES TO SOLIDIFICATION
FROTH
ORGANICS
FINAL TREATED EFFLUENT STORAGE TANKS
REVERSE OSMOSIS
EVAPORATOR FEED POND
WASTE FROM STORAGE TANKS
DISSOLVED AIR FLOTATION
EXCESS TREATED STORMWATER
BATCHES WITH HIGH SCALING POTENTIAL
REJECTS
AQUEOUS ORGANIC TREATMENT SYSTEM
CENTRIFUGE
GRANULAR MEDIA FILTERS
BATCHES CONTAINING HIGH DISSOLVED SOLIDS
SOLIDS
DRUMS TO INCINERATOR
FILTRATE
TO ADDITIONAL POLISHING (IF REQUIRED)
DISCHARGE IF CLEAN
SLUDGE FILTERS
INTERMEDIATE STORAGE TANKS
FILTRATE
FILTER CAKE TO SOLIDIFICATION
SURFACE DRAINAGE COLLECTION PONDS
SURFACE DRAINAGE
IF CONTAMINATED
REACTION TANKS
WASTE FROM STORAGE TANKS
SLUDGE THICKENING TANKS
SUPERNATANT
GRANULAR MEDIA FILTERS
SLUDGE
SLUDGE
REACTOR CLARIFIER
INORGANIC TREATMENT SYSTEM
REACTION TANK
LANDFILL LEACHATE (IF NECESSARY)
EQUALIZATION TANK
MISCELLANEOUS TREATMENT SYSTEM

FIGURE 3.13

PICTORIAL FLOW DIAGRAM
PHYSICAL/CHEMICAL TREATMENT

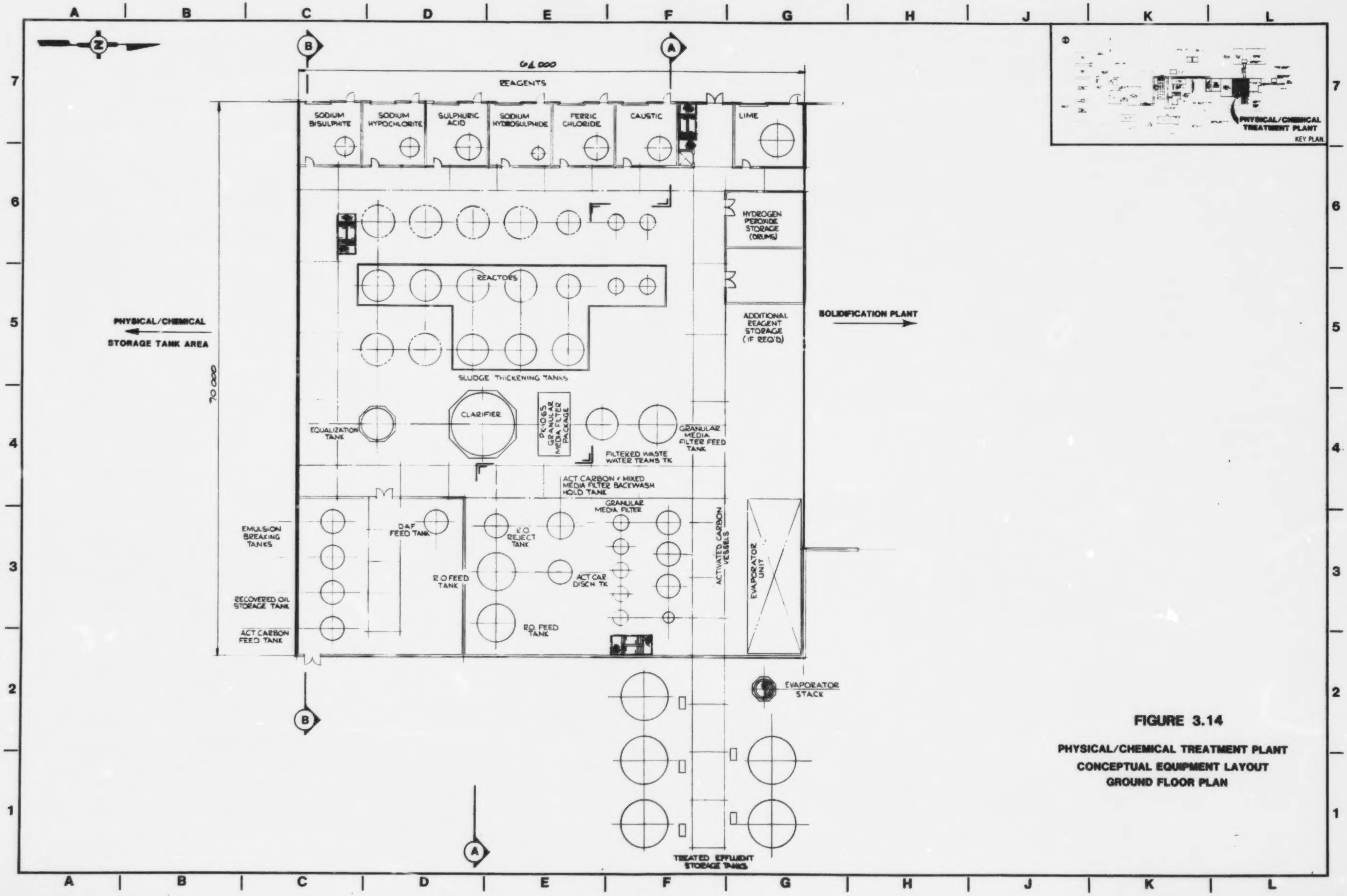
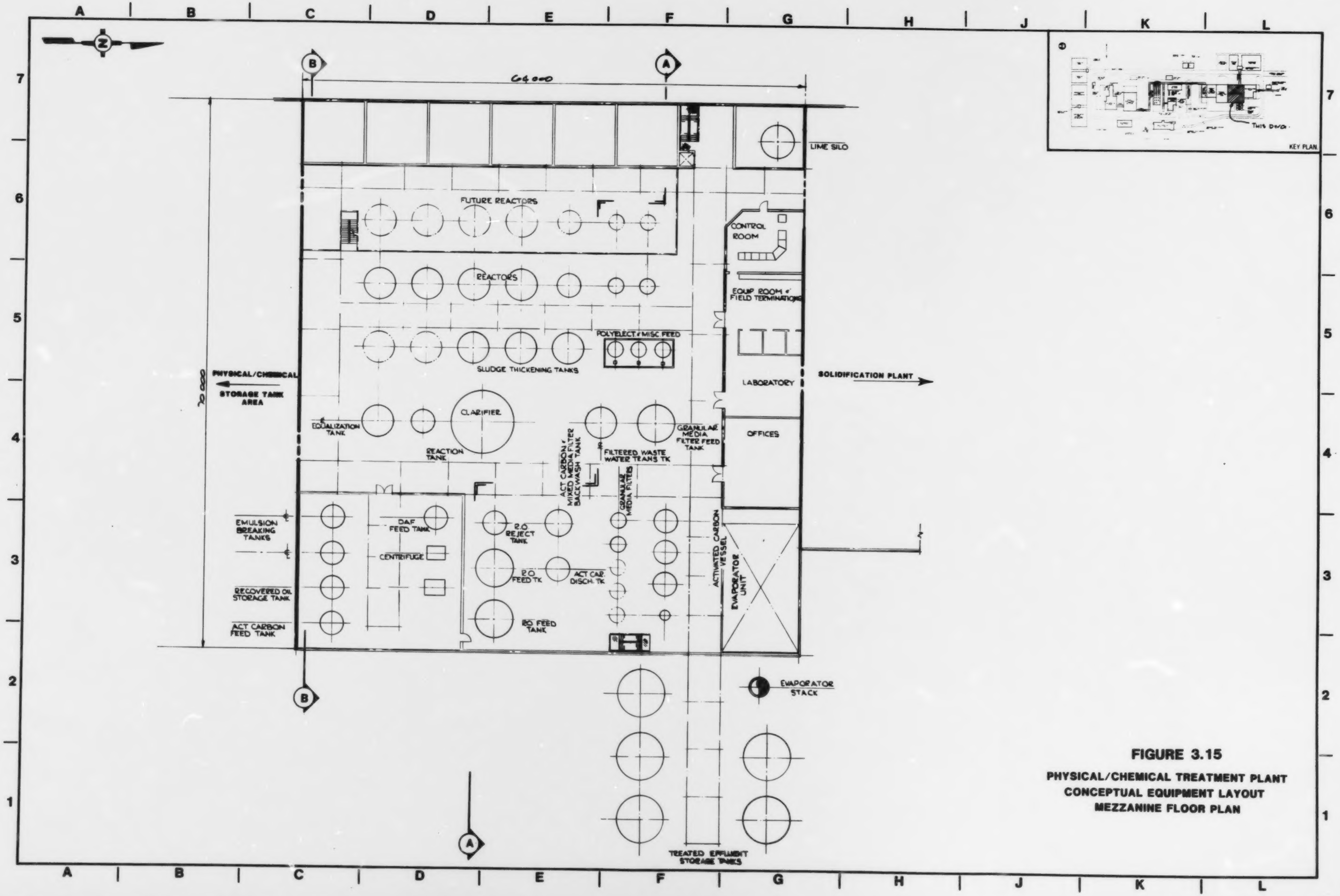

A
B
C
D
E
F
G
H
J
K
L
7
6
5
4
3
2
1
N
B
A
61 000
REAGENTS
SODIUM BISULPHITE
SODIUM HYPOCHLORITE
SULPHURIC ACID
SODIUM HYDROSULPHIDE
FERRIC CHLORIDE
CAUSTIC
LIME
HYDROGEN PEROXIDE STORAGE (DRUMS)
ADDITIONAL REAGENT STORAGE (IF REQ'D)
REACTORS
SLUDGE THICKENING TANKS
70 000
PHYSICAL/CHEMICAL STORAGE TANK AREA
SOLIDIFICATION PLANT
EQUALIZATION TANK
CLARIFIER
PK-1065 GRANULAR MEDIA FILTER PACKAGE
GRANULAR MEDIA FILTER FEED TANK
FILTERED WASTE WATER TRANS TK
ACT CARBON & MIXED MEDIA FILTER BACKWASH HOLD TANK
GRANULAR MEDIA FILTER
EMULSION BREAKING TANKS
DAF FEED TANK
R.O. REJECT TANK
R.O FEED TANK
ACT CAR DISCH TK
ACTIVATED CARBON VESSELS
EVAPORATOR UNIT
RECOVERED OIL STORAGE TANK
ACT CARBON FEED TANK
R.O FEED TANK
EVAPORATOR STACK
TREATED EFFLUENT STORAGE TANKS
PHYSICAL/CHEMICAL TREATMENT PLANT
KEY PLAN

FIGURE 3.14

PHYSICAL/CHEMICAL TREATMENT PLANT
CONCEPTUAL EQUIPMENT LAYOUT
GROUND FLOOR PLAN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L
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6
5
4
3
2
1
N
B
A
64000
70000
LIME SILO
FUTURE REACTORS
CONTROL ROOM
REACTORS
EQUIP ROOM & FIELD TERMINATIONS
POLYELECT & MISC FEED
SLUDGE THICKENING TANKS
PHYSICAL/CHEMICAL STORAGE TANK AREA
LABORATORY
SOLIDIFICATION PLANT
CLARIFIER
EQUALIZATION TANK
REACTION TANK
ACT CARBON & MIXED MEDIA FILTER BACKWASH TANK
FILTERED WASTE WATER TRANS TK
GRANULAR MEDIA FILTER FEED TANK
OFFICES
GRANULAR MEDIA FILTERS
EMULSION BREAKING TANKS
DAF FEED TANK
CENTRIFUGE
R.O. REJECT TANK
R.O. FEED TK
ACT CAR. DISCH. TK
ACTIVATED CARBON VESSEL
EVAPORATOR UNIT
RECOVERED OIL STORAGE TANK
ACT CARBON FEED TANK
RO FEED TANK
EVAPORATOR STACK
TREATED EFFLUENT STORAGE TANKS
THIS DWG.
KEY PLAN

FIGURE 3.15

PHYSICAL/CHEMICAL TREATMENT PLANT
CONCEPTUAL EQUIPMENT LAYOUT
MEZZANINE FLOOR PLAN

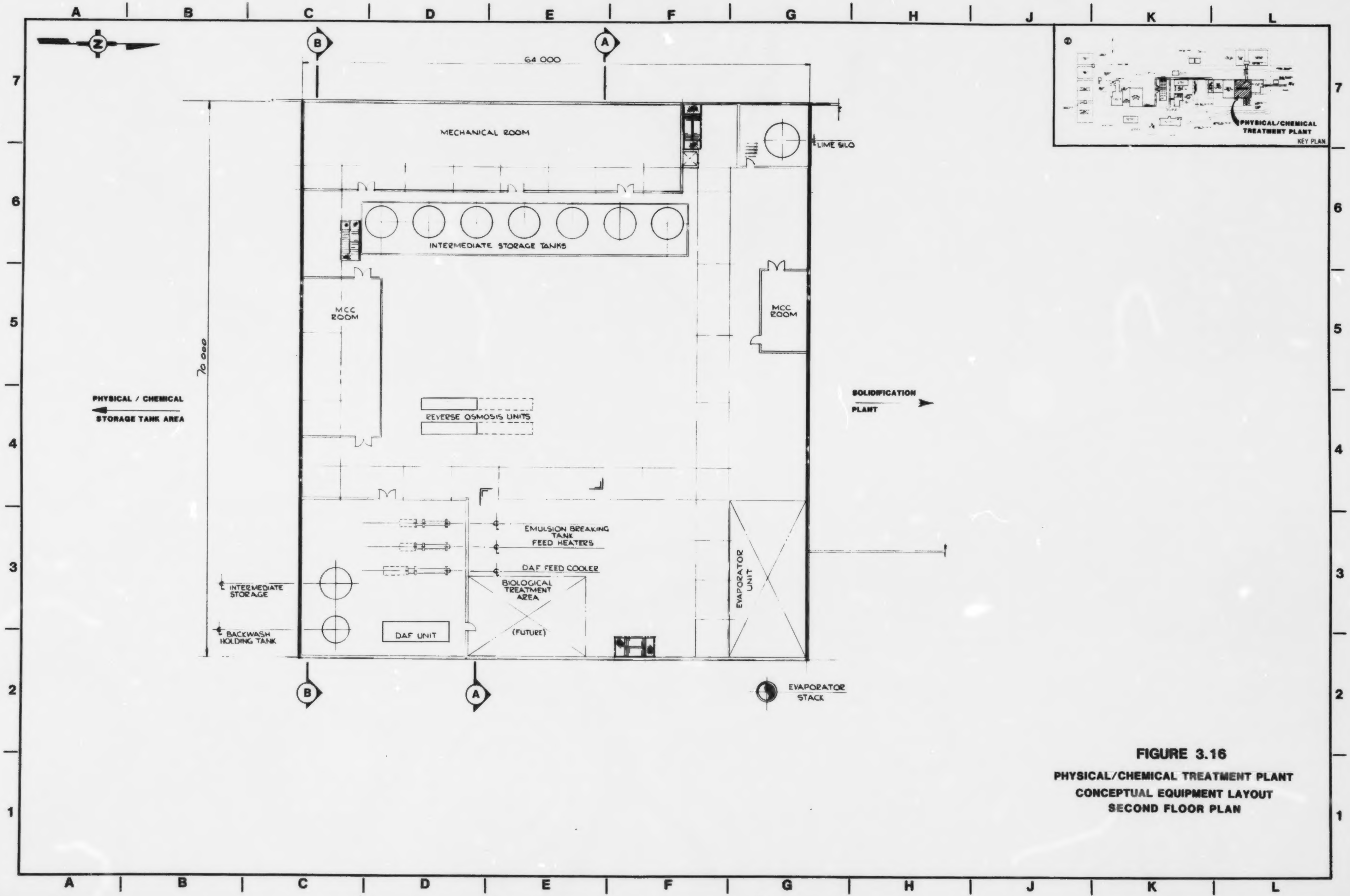

A
B
C
D
E
F
G
H
J
K
L
7
6
5
4
3
2
1
Z
B
A
64 000
70 000
MECHANICAL ROOM
LIME SILO
INTERMEDIATE STORAGE TANKS
MCC ROOM
MCC ROOM
PHYSICAL / CHEMICAL
STORAGE TANK AREA
REVERSE OSMOSIS UNITS
SOLIDIFICATION PLANT
EMULSION BREAKING TANK FEED HEATERS
DAF FEED COOLER
BIOLOGICAL TREATMENT AREA
(FUTURE)
EVAPORATOR UNIT
INTERMEDIATE STORAGE
BACKWASH HOLDING TANK
DAF UNIT
EVAPORATOR STACK
PHYSICAL/CHEMICAL TREATMENT PLANT
KEY PLAN

FIGURE 3.16

PHYSICAL/CHEMICAL TREATMENT PLANT
CONCEPTUAL EQUIPMENT LAYOUT
SECOND FLOOR PLAN

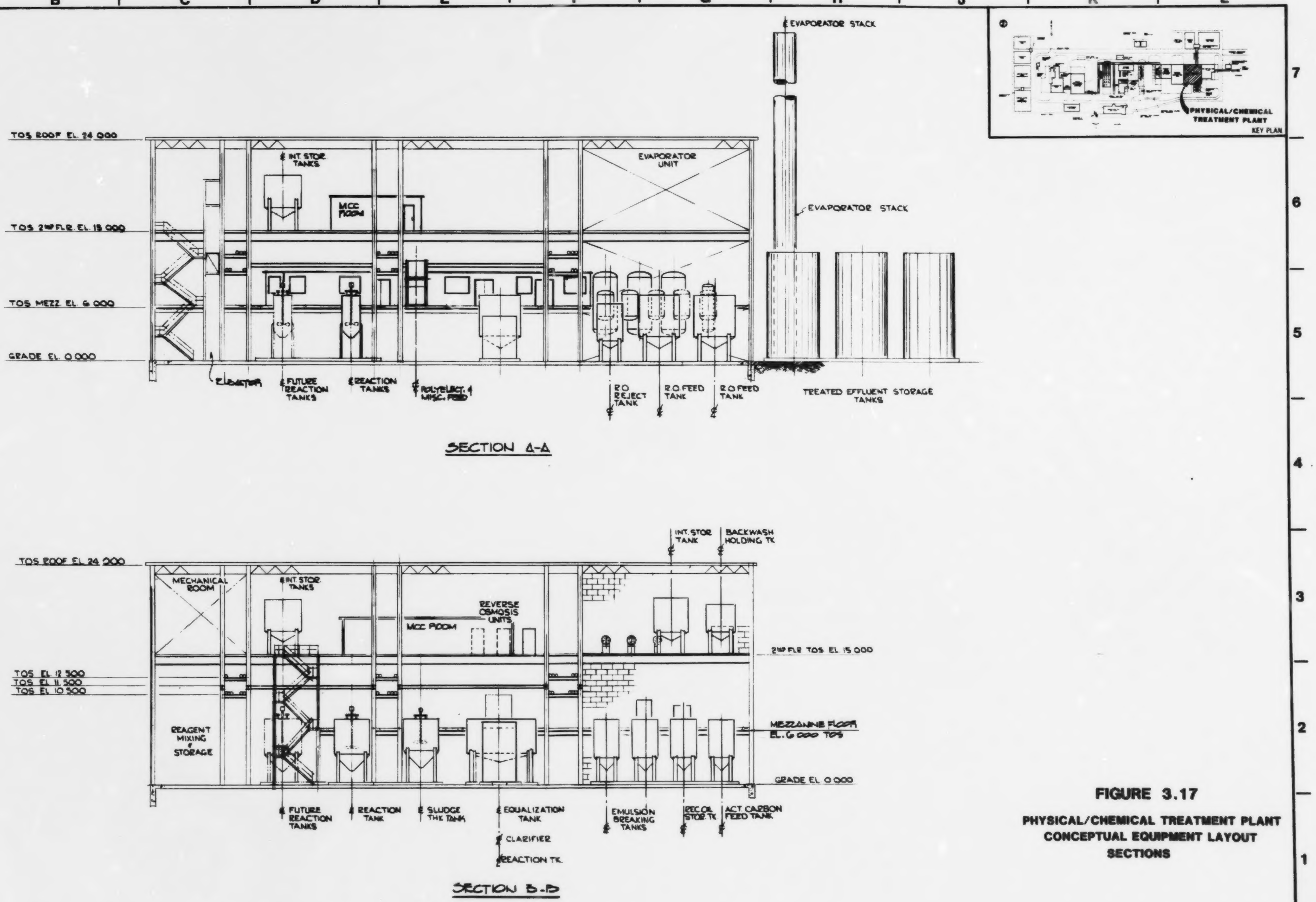

A B C D E F G H J K L
7 6 5 4 3 2 1
℄ EVAPORATOR STACK
PHYSICAL/CHEMICAL TREATMENT PLANT
KEY PLAN
TOS ROOF EL. 24 000
℄ INT. STOR TANKS
MCC ROOM
EVAPORATOR UNIT
EVAPORATOR STACK
TOS 2ND FLR. EL. 15 000
TOS MEZZ EL 6 000
GRADE EL. 0 000
ELEVATOR
℄ FUTURE REACTION TANKS
℄ REACTION TANKS
℄ POLYELECT. & MISC. FEED
R.O. REJECT TANK
R.O. FEED TANK
R.O. FEED TANK
TREATED EFFLUENT STORAGE TANKS
SECTION A-A
INT. STOR TANK
BACKWASH HOLDING TK
TOS ROOF EL 24 000
MECHANICAL ROOM
℄ INT. STOR. TANKS
REVERSE OSMOSIS UNITS
MCC ROOM
2ND FLR TOS EL 15 000
TOS EL 12 500
TOS EL 11 500
TOS EL 10 500
REAGENT MIXING & STORAGE
MEZZANINE FLOOR EL. 6 000 TOS
GRADE EL 0 000
℄ FUTURE REACTION TANKS
℄ REACTION TANK
℄ SLUDGE THK TANK
℄ EQUALIZATION TANK
℄ CLARIFIER
℄ REACTION TK.
EMULSION BREAKING TANKS
REC OIL STOR TK
ACT CARBON FEED TANK
SECTION B-B

FIGURE 3.17

PHYSICAL/CHEMICAL TREATMENT PLANT CONCEPTUAL EQUIPMENT LAYOUT SECTIONS

Provision has been made in the building layout to accommodate additional physical/chemical or biological treatment processes as may be required in the future to respond to changing waste profiles.

3.4.2.1 Inorganic Waste Treatment System

The inorganic waste treatment system comprises treatment, storage and disposal as follows:

- primary treatment,
- secondary treatment,
- intermediate storage,
- effluent polishing,
- final effluent storage, and
- evaporation.

Primary Treatment

Phase Separation. Primary phase separation (by gravity) to separate immiscible liquids and/or slurries (where required) is carried out in the respective inorganic waste storage tanks described in Section 3.7.3.2 (p. 177).

Dissolution/Slurrying. Dissolution and/or slurrying of non-pumpable inorganic solids which require physical/chemical treatment prior to solidification, is carried out either in one of the bulk inorganic unloading basins described in Section 3.2.2.2 (p. 39), or in the solidification plant described in Section 3.5.1.5 (p. 147) if the inorganic solids require crushing or grinding prior to dissolution/slurrying.

Blending. Blending and/or equalization to combine compatible inorganic wastes, to enhance treatability is carried out in the respective inorganic waste storage tanks described in Section 3.7.3.2 (p. 177).

Secondary Treatment

Chemical Oxidation and Reduction. Four reactors are provided to receive waste from the inorganic waste storage tanks and if required, the discharge from the aqueous organic waste treatment system and miscellaneous wastes, for carrying out chemical oxidation and reduction reactions as follows:

- 2 - 10 m^3 capacity reactors,
- 1 - 20 m^3 capacity reactor, and
- 1 - 40 m^3 capacity reactor.

One 10 m^3 capacity and the 20 m^3 capacity reactors are equipped with cooling jackets to enable the heat liberated by the neutralization of strong acids and alkalis to be removed during the reaction sequence and thus avoid excessive increases in fluid temperatures.

In addition to oxidation/reduction reactions, the four reactors can also be used for neutralization/precipitation, coagulation and solids settling steps.

Provision is also made for the addition of reagents (sulphuric acid, caustic, lime, ferric chloride, sodium hydrosulphide, polyelectrolyte, sodium bisulphite, sodium hypochlorite and other reagents see Section 3.4.2.4 (p. 120), to assist in the reaction sequences.

Each of the four reactors, which are located on the ground floor (see Figure 3.14), are of vertical, cylindrical configuration, equipped with an agitator to achieve effective mixing during the reaction sequence, and with a conical bottom to enhance the efficiency of phase separation where required and to facilitate the discharge of the entire contents of each reactor at the completion of the reaction sequence.

After the reaction sequence is complete, the contents of the reactors are pumped to the sludge thickening tanks.

Neutralization and Precipitation. Three identical 40 m^3 capacity reactors are provided to receive waste from the inorganic waste storage tanks and if required, the discharge from the aqueous organic waste treatment system, for carrying out neutralization/precipitation reactions on wastes which do not require pretreatment by oxidation/reduction. Exothermic reactions involving the neutralization of strong acids and alkalis are carried out in one of the jacketed reactors to enable the temperature rise of the mixture to be controlled during the reaction sequence. In addition, temperature increases are controlled, if necessary, by adjusting the rate of reagent addition.

In addition to neutralization/precipitation reactions, the three reactors also function as batch coagulation and solids settling vessels. This is particularly useful for wastes which require an intermediate solids separation step between successive stages of precipitation.

Provision is also made for the addition of reagents to assist in the precipitation reactions.

Each of the three reactors, which are located in line with the oxidation/reduction reactors (see Figure 3.14), are also of vertical, cylindrical configuration, equipped with conical bottoms and agitators.

After the reaction sequence is complete, the contents of the reactors are pumped to the sludge thickening tanks.

Coagulation/Sedimentation. Three 40 m^3 capacity sludge thickening tanks are provided to receive precipitated solids from the reactors, the activated carbon and granular media filter backwash holding tanks, and the clarifier of the miscellaneous waste treatment system for further thickening by gravity.

Provision is made for the addition of a high molecular weight polyelectrolyte to enhance the settling characteristics of the suspended solids and if necessary ferric chloride. Provision is also made for the addition of sulphuric acid and caustic for neutralization if required.

Each of the three sludge thickening tanks, which are located on the ground floor, adjacent to the reactors (see Figure 3.14), are also of vertical cylindrical configuration equipped with conical bottoms and agitators.

After the sludge has been thickened, the contents of the sludge thickening tanks are pumped to the sludge filters. Each sludge thickening tank is capable of feeding sludge to two of the three sludge filters.

In addition to increasing the solids concentration of sludges being fed to the sludge filters, the sludge thickening tanks provide a source of recycle sludge to enhance the precipitation reactions in the neutralization/precipitation reactors.

Sludge Dewatering. Three plate and frame pressure sludge filters are used to dewater thickened sludge from the sludge thickening tanks with the filter cake being sent either to the solidification plant (p. 139) or to the incineration plant (p. 54) if of high organic content and the filtrate being routed to the intermediate storage tanks via filtrate tanks. A suitable filter aid such as diatomaceous earth will be used where required to enhance the dewaterability of the thickened sludge.

The three sludge filters are located at high level in the solidification building (see Figure 3.21).

Intermediate Storage Tanks

Seven 40 m^3 capacity intermediate storage tanks are provided to receive filtrate (partially treated process wastes) from the filtrate tanks of the sludge filters. In addition, supernatant from the reactors and sludge thickening tanks may be pumped directly to the intermediate storage tanks. These seven intermediate storage tanks, which are located on the second floor (see Figure 3.16), are of vertical, conical bottom, cylindrical configuration.

The filtrate in the intermediate storage tanks will be sampled and tested to confirm that secondary treatment has produced a filtrate of acceptable quality prior to effluent polishing. Where the filtrate quality is unacceptable, it will be routed back to the reactors (pp 107,108) for retreatment.

Effluent Polishing

Effluent polishing is the final stage of physical/chemical treatment designed to ensure that the treated effluent is of a quality which enables it to be either reused on site or discharged from the Facility by evaporation.

Effluent polishing (as applied to the final stages of treatment of the process wastes), consists of one or a combination of the following unit operations:

- Granular media filtration - to reduce the concentrations of residual suspended solids and oil and grease.
- Activated carbon adsorption - to reduce the concentrations of residual dissolved organics (and selected inorganics).
- Reverse osmosis - to reduce the total dissolved solids concentration of the treated effluent, reduce the concentrations of residual dissolved heavy metals and other inorganic contaminants of concern and remove additional dissolved organic contaminants prior to reuse or discharge to atmosphere by evaporation.
- Evaporation - to reduce the total dissolved solids concentration of treated effluents which are not suitable for final polishing by reverse osmosis.

The system enables each of the effluent polishing unit operations to be used alone in a single or multiple pass configuration, or in combination, as required to meet the discharge/reuse requirements.

For difficult to treat or complex wastes, the type and combination of effluent polishing steps required for each batch of waste will be determined in advance based on the results of analyses of the partially treated wastes (after primary and/or secondary treatment).

Filtrates (partially treated process wastes) are discharged by gravity from the intermediate storage tanks of the inorganic and aqueous organic treatment systems, to the granular media filter feed tank. Provision is made for the addition of selected reagents (caustic and sulphuric acid) prior to effluent polishing. The granular media filter feed tank, which is located on the ground floor, has a capacity of 50 m^3, and is equipped with an agitator and conical bottom.

To maintain peak efficiency, the granular media filter and activated carbon vessels are backwashed using effluent from the reverse osmosis feed tank complete with air scour, with the resulting backwash being recycled through the activated carbon and granular media filter backwash holding tank to the sludge thickening tanks.

The activated carbon and granular media filter backwash holding tank, which is also located on the ground floor, has a capacity of 40 m^3, and is equipped with an agitator and conical bottom.

Granular Media Filtration. Two 100% granular media filters each of 50 m^3/h capacity operate in parallel (one operating - one standby) to reduce the concentrations of residual suspended material (suspended solids, oil and grease) prior to carbon adsorption and reverse osmosis. The granular media filters are located on the ground floor (see Figure 3.14).

Activated Carbon Adsorption. Three equal sized units each with a capacity of 50 m^3/h and arranged such that two units operate in series at any one time with the third unit on standby. The third unit, whilst on standby, is also used to treat effluents from the miscellaneous waste treatment system if required. The activated carbon vessels are located on the ground floor (see Figure 3.14).

Batches of effluent, which contain total dissolved solids (TDS) concentrations in excess of 3.5% by weight, are routed directly to either solidification or to evaporation. 50% of the treated effluent from activated carbon adsorption is expected to have total dissolved solid (TDS) concentrations of less than 3.5% by weight and this is discharged to the reverse osmosis feed tanks for further polishing.

Initially, all of the spent carbon from the activated carbon adsorption units is either incinerated on-site, or sent off-site for regeneration at an approved facility.

Reverse Osmosis (RO). Two equal sized units, each with a capacity of 25 m^3/h are arranged such that the two units operate in parallel. Each RO treatment module is capable of polishing treated effluents from the inorganic and aqueous organic treatment systems.

The permeate from the RO units is discharged to the treated effluent storage tanks and the rejects are discharged to the reverse osmosis reject tank from where they are pumped to the treated liquid storage tanks in the solidification plant (p. 145) or to the evaporator feed pond.

Normally, one of the two RO units is in operation at any one time. The second unit provides additional operational flexibility and reliability and additional RO treatment capacity as follows:

- The standby unit operates during periods when the main operating unit is out of service for routine maintenance or unscheduled repairs.

- The second module is also required for polishing effluents from the miscellaneous waste treatment system in the event that additional polishing is required prior to either on-site reuse or discharge by evaporation, the combined treatment capacity of both RO treatment modules (50 m^3/h) corresponding to the design capacity of the miscellaneous waste treatment system (p. 118).

- The second module also provides additional treatment capacity for retreating batches of waste which require retreatment in order to meet the requirements for on-site reuse or discharge by evaporation.

Final Effluent Storage

Five 320 m^3 capacity treated effluent storage tanks are provided for the purpose of storing final polished effluent for testing prior to recycling on-site or discharging by evaporation. The treated effluent storage tanks are of vertical, cylindrical configuration and located outside the physical/chemical treatment building (see Figure 3.14).

Depending on the test results, the treated effluent is discharged to:

- the recycle water pond if being reused on-site,
- the evaporator feed pond if to be discharged by evaporation,
- the intermediate storage tanks if to be retreated by further polishing, or
- the treated liquid storage tanks in the solidification plant if to be solidified.

Evaporation

The evaporation system consists of feed forward triple effect units with two preheaters. This configuration maximizes steam economy. The three effects are forced circulation type to minimize scaling.

For maximum flexibility, the evaporation system is capable of operating in any one of three modes:

- condensing mode, where the evaporator effluents are used to produce distilled water for recycling,

- venting mode, which discharges excess treated effluent from the Facility by venting steam from all three units, and

- partial venting mode, which enables some steam to be condensed for recycle with the remainder being vented as steam to the atmosphere.

The evaporator receives treated effluent pumped from the evaporator feed pond. Condensate produced during the evaporation process is discharged to the recycle water pond (of 5000 m^3 capacity) and stored with polished effluent from the treated effluent storage tanks. The contents of the recycle water pond are pumped via two 100% service water supply pumps to the service water storage tank (p. 204).

3.4.2.2 Aqueous Organic Waste Treatment System

The aqueous organic waste treatment system comprises treatment and storage as follows:

- primary treatment,
- secondary treatment,
- effluent polishing, and
- intermediate storage,

Primary Treatment

Phase Separation. Primary phase separation (by gravity) to separate immiscible organic liquids and/or oily solids (wherever practical) is carried out in the respective aqueous organic waste storage tanks described in Section 3.7.3.2 (p. 181). Any immiscible organic liquids or oily solids which separate during storage are transferred to the incinerator tank farm prior to being incinerated.

Blending. Blending of aqueous organic wastes also takes place in the aqueous organic waste storage tanks described in Section 3.7.3.2 (p. 181).

Secondary Treatment

The equipment associated with secondary treatment of the aqueous organic waste treatment system and the feed tank and backwash tank associated with activated carbon adsorption are located on two floors at the south east corner of the physical/chemical treatment building. They are separated from the other physical/chemical processes by a solid wall for safety and fire protection as shown on Figures 3.14, 3.15 and 3.16.

Emulsion Breaking. Two 25 m^3 capacity emulsion breaking tanks are provided to demulsificate batches of heated aqueous organic waste from the aqueous organic storage tanks and recycled aqueous organic waste from the dissolved air flotation (DAF) feed tank.

Provision is made for the addition of polyelectrolyte and sulphuric acid, and heat using tank heaters to assist in the demulsification and solids settlement.

The solids which settle out by gravity in the emulsion breaking tanks are withdrawn into 200 L drums for disposal in the incineration plant. The demulsified liquid phases (aqueous and organic) are pumped to the centrifuge for separation.

Each of the emulsion breaking tanks are of vertical, cylindrical configuration equipped with an agitator and conical bottom and located on the ground floor (see Figure 3.14).

For some batches of waste, centrifugation may be used to separate suspended solids from wastes prior to emulsion breaking in lieu of gravity separation. The solids which separate out by centrifugation are withdrawn into portable containers for destruction in the incineration plant; the remaining liquids are then treated in the emulsion breaking tanks.

Centrifugation. One 17 m^3/h capacity centrifuge is provided to separate aqueous organic mixtures after demulsification and is capable of processing the contents of each emulsion breaking tank in approximately 1 1/2 hours. The organic phase recovered by centrifugation is transferred to the recovered oil storage tank and then pumped to the incinerator tank farm for destruction in the incineration plant (see Section 3.7.3.1 p. 170), the recovered aqueous phase receives additional treatment by dissolved air flotation.

Provision is made at the recovered oil storage tank for the addition of caustic and to recycle the organic waste through the emulsion breaking tanks for further demulsification, if required.

Dissolved Air Flotation (DAF). One 17 m^3/h capacity dissolved air flotation unit is used to achieve additional removal of suspended (immiscible) organics and finely divided suspended solids which are not removed by centrifugation.

The recovered aqueous phase from the centrifuge is routed to the dissolved air flotation feed tank along with recycled partially treated aqueous organic effluents and backwash from activated carbon adsorption.

Provision is made for the addition of caustic to neutralize any acid remaining from emulsion breaking. The solids which settle to the bottom of the DAF feed tank are withdrawn into 200 L drums for destruction in the incineration plant. The liquid phase is pumped through a cooler to the DAF package.

The DAF package consists of an in-line mixer which feeds into a flocculator tank (equipped with an agitator for additional mixing) and then into the dissolved air flotation tank. A portion of the liquid in the dissolved air flotation tank is pumped through an air dissolving vessel (where compressed air, needed for the flotation process, is added) and then back into the dissolved air flotation tank.

The oily "float" which is skimmed from the surface of the DAF unit is sent to the recovered oil storage tank, where it is pumped to the incinerator tank farm for ultimate destruction in the incineration plant (see Section 3.7.3.1, p. 170). The treated effluent from the DAF unit is routed to the prepolishing activated carbon adsorption unit feed tank.

The solids which settle to the bottom of the DAF unit are removed by the sludge collector and withdrawn into 200 L drums for destruction in the incineration plant.

The DAF feed tank, is located on the ground floor (see Figure 3.14), and the DAF package is located on the second floor (see Figure 3.17).

Effluent Polishing

Activated Carbon Adsorption. One 17 m^3/h capacity activated carbon adsorption unit and associated equipment is provided to reduce the dissolved organic loading of the partially treated aqueous organic wastes prior to final effluent polishing.

The treated effluent is received in the activated carbon vessel feed tank, which can also accommodate the treated effluent from the activated carbon vessel for recycling if necessary. From there, the treated effluent is pumped to the activated carbon vessel for the purpose of prepolishing the partially treated aqueous organic effluents prior to further treatment in the inorganic waste treatment system.

The prepolished effluent is discharged from the activated carbon vessel to the activated carbon vessel discharge tank, from where it is pumped to intermediate storage or to the reactors of the inorganic waste treatment system.

To maintain peak efficiency, the activated carbon vessel is backwashed using effluent from the activated carbon vessel discharge tank complete with air scour, with the resulting backwash being routed to the activated carbon vessel backwash holding tank from where it is pumped to the DAF feed tank for retreatment.

The activated carbon vessel is located on the ground floor (see Figure 3.16). Initially the spent carbon is incinerated in the incineration plant or sent off-site for regeneration.

Intermediate Storage

Partially treated effluent from the aqueous organic waste treatment system is discharged into a single 40 m^3 intermediate storage tank, from where it undergoes further effluent polishing by granular media filtration, additional treatment by activated carbon adsorption and final polishing by reverse osmosis utilizing the effluent polishing train of the inorganic waste treatment system as described in Section 3.4.2.1 (p. 110).

The intermediate storage tank is located on the second floor (see Figure 3.16).

The partially treated effluent in the intermediate storage tank is sampled and tested to confirm that secondary treatment has produced a partially treated effluent of acceptable quality prior to effluent polishing in the inorganic waste treatment system. Where the effluent quality is unacceptable, it is routed back to the emulsion breaking tanks (p. 115), the oxidation/reduction reactors (p. 107), or the neutralization/precipitation reactors (p. 108) for retreatment.

3.4.2.3 Miscellaneous Waste Treatment System

Primary/Secondary Treatment

Equalization. One 80 m^3 capacity equalization tank is used to combine miscellaneous wastes comprising:

- contaminated water from the surface water ponds
- contaminated landfill leachate, and
- contaminated water from the landfill storm detention pond.

Provision is made for adding sodium hypochlorite to the equalization tank in the event that a cyanide oxidation step is required prior to metals precipitation.

The equalization tank is located on the ground floor (see Figure 3.14).

Neutralization/Precipitation. One 20 m^3 capacity reaction tank is used to receive batches of miscellaneous wastes from the equalization tank for neutralization/precipitation reactions.

Provision is made for the addition of the appropriate reagents to assist in the reaction sequence. Sodium hydrosulphide, lime or caustic, ferric chloride and/or sodium bisulphite, sodium hypochlorite and sulphuric acid are those reagents (see Section 3.4.2.4 p. 120).

The reaction tank, is located on the mezzanine floor (see Figure 3.15).

In addition to neutralization/precipitation reactions, the reaction tank is also capable of carrying out oxidation/reduction reactions as required to treat the types of contaminants present in the miscellaneous waste.

After the reaction sequence is complete, the contents of the reaction tank flow by gravity to the waste water clarifier.

Flocculation/Sedimentation. One 50 m^3/h capacity solids contact type clarifier is used to flocculate and settle out solids in the miscellaneous waste. It is located on the ground floor (see Figure 3.14).

Provisions is made for the addition of polyelectrolyte, clay and other reagents to the centre well of the clarifier to improve the solids settling characteristics.

Sludge which accumulates in the bottom of the clarifier is discharged intermittently and pumped to the sludge thickening tanks in the inorganic waste treatment system (p. 108).

Clarifier overflow is directed to the granular media filters for polishing.

Effluent Polishing

Granular Media Filtration. Two 50% capacity (25 m^3/h) gravity feed granular media filters are provided to remove finely divided, suspended solids not removed by the flocculation/clarification step. They are located on the ground floor (see Figure 3.14).

To maintain peak efficiency, the granular media filters are backwashed, complete with air scour, with the resulting backwash being discharged to the equalization tank.

The treated effluent from the granular media filters overflows into the filtered waste water transfer tank. The filtered waste water transfer tank is located on the ground floor.

The treated effluent is then pumped from the filtered waste water transfer tank either to the treated effluent storage tanks in the inorganic waste treatment system directly, or via the standby activated carbon filter and the reverse osmosis units in the inorganic waste treatment system, if additional polishing of the treated effluent is required.

3.4.2.4 Reagent Storage and Feeding System

The various physical/chemical treatment processes which make up the inorganic, aqueous organic and miscellaneous waste treatment systems require the addition of various reagents for treatment purposes. These reagents are:

- lime (15% by weight slurry),
- caustic (50% by weight solution)
- ferric chloride (37% by weight solution),
- sodium hydrosulphide (45% by weight solution),
- sulphuric acid (93.5% by weight solution),
- sodium hypochlorite (12% available chlorine),
- sodium bisulphite (38% by weight solution),
- hydrogen peroxide,
- polyelectrolyte, and
- ferrous sulphate.

The reagents are used in the treatment processes as follows:

- Common reagent for neutralization of acidic wastes is 15% lime slurry. A 50% caustic solution may be used as an alternate reagent. Alkaline special waste may also be utilized depending on its availability and quality.

- Common reagent for neutralization of alkaline wastes is 93.5% sulphuric acid. Acid waste may also be utilized depending on its availability and quality.

- Common reagents for chromium waste treatment are sodium bisulphite, sulphuric acid and caustic.

- Hydrogen peroxide is provided for the destruction of trace organics.

- Sodium hydrosulphide is provided for the precipitation of heavy metals.

- Ferric chloride and polyelectrolyte are provided for flocculation purposes.

Hydrated lime ($Ca(OH)_2$) is received in bulk by truck and stored in a lime storage silo in a separate room (see Figure 3.14). The lime is mixed with water in the lime slurry tank to make a slurry of 15% lime by weight for use in the treatment processes.

Caustic, ferric chloride, sulphuric acid, sodium hypochlorite, sodium hydrosulphide and sodium bisulphite are received in bulk by tank truck and stored in tanks in separate rooms (see Figure 3.14) for use in the treatment processes.

Hydrogen peroxide is received in 200 L drums and polyelectrolyte and miscellaneous reagents are received in bags or drums. Hydrogen peroxide is stored in a separate room (see Figure 3.14); polyelectrolyte and miscellaneous reagents are stored in a separate additional reagent storage room (see Figure 3.14).

Polyelectrolyte solutions are prepared in the polyelectrolyte preparation and feeding system package located on the mezzanine floor (see Figure 3.15).

Miscellaneous and other reagents which may be required to treat the miscellaneous waste in the waste water clarifier are added using the miscellaneous feed package located on the mezzanine floor (see Figure 3.15).

3.4.2.5 Control Centre, Laboratory and Offices

The physical/chemical treatment building houses the physical/chemical control centre, physical/chemical laboratory and offices and facilities for the operators and laboratory staff associated with the inorganic tank truck unloading area, inorganic drum storage and handling building, physical/chemical storage tank area, physical/chemical treatment plant and solidification plant. These facilities are located on the mezzanine floor (see Figure 3.15).

Control Centre

The physical/chemical control centre consists of the following:

- A control room containing the control consoles and panels housing all the operator interface facilities including television monitors (CRTs), keyboards, printers, annunciators and back-up instrumentation.

- An equipment room containing all the field cable terminations and processing equipment for the process control system.

- A storage room for records and minor consumable items.

Operators in the physical/chemical control room have responsibility for the following areas:

- physical/chemical storage tank area,
- physical/chemical treatment plant,
- solidification plant,
- selected critical alarms from inorganic waste storage and handling areas, and

- potentially contaminated and uncontaminated drainage sumps and ponds.

The control console in the control room houses the following functions for the above areas:

- process control,
- plant status monitoring,
- plant safety and emergency systems monitoring,
- hazard annunciation, and
- data management.

Laboratory

The physical/chemical laboratory and its staff carry out functions that include:

- Verification testing of all inorganic wastes delivered in drums.

- Bench testing of proposed treatment processes for individual inorganic wastes. This may be necessary when certain inorganic wastes are received at the Facility for the first time or when abnormal changes to inorganic waste compositions are encountered.

- Establishing optimum physical/chemical treatment procedures and reagent quantities necessary for the treatment of inorganic wastes.

- Carrying out process control analyses to ensure that the inorganic treatment processes are proceeding as expected.

- Establishing optimum solidification formulae.

- Carrying out physical and chemical (leachability) testing of solidified waste samples.

The laboratory comprises three sections; the process control laboratory, the instrumentation laboratory and the solidification laboratory as addressed in Section 3.7.11.2 (p. 250).

Offices

Offices and facilities (such as lunch room, locker room, showers and toilets) are provided for the supervisory and operating personnel associated with the inorganic tank truck unloading area, inorganic drum storage and handling building, physical/chemical storage tank area, physical/chemical treatment plant and solidification plant.

3.4.2.6 Mechanical and Electrical Rooms

Provision is made on the second floor, (see Figure 3.17), to accommodate mechanical and electrical rooms to house equipment necessary for servicing the physical/chemical storage tank area, physical/chemical treatment plant and solidification plant.

Mechanical Room

The mechanical room houses the heating, ventilating and air conditioning (HVAC) equipment which supplies six main levels of service as follows:

- air conditioning,
- heating and cooling,
- heating and ventilation,
- process extract,
- general extract, and
- emergency extract.

The functional requirements of each level of service provide for the:

- capture, treatment and removal of pernicious air borne contaminants,
- adequate comfort for occupants, and
- suitable environment for equipment and waste being treated.

Air borne contaminants (including dust, fumes, inorganic and organic vapours and flammable gases) are treated and/or removed using a combination of air scrubbers and activated carbon adsorption.

Comfort conditions for occupants are achieved by controlling temperature, humidity, air movement, noise level and air purity as required, using standard HVAC systems.

A suitable environment for equipment and waste being treated is achieved by controlling temperature, humidity and air purity as required, using standard HVAC systems.

In addition to the HVAC equipment, the mechanical room houses the vent gas and exhaust air cleaning systems associated with the following:

- storage tanks located in the physical/chemical storage tank area,
- chemical oxidation/reduction, and neutralization/precipitation reactors of the inorganic waste treatment system, and
- reagent storage tanks in the physical/chemical treatment plant.

The vent gas and exhaust gas air cleaning systems include a combination of filtration, vent scrubbing and vent adsorbers.

Electrical Room

The electrical room houses the switchgear and motor control centres and other electrical equipment associated with the physical/chemical storage tank area, physical/chemical treatment plant, solidification plant, inorganic drum storage and handling building and inorganic tank truck unloading area.

3.4.3 NORMAL OPERATION

The following outlines the physical/chemical treatment plant operating and control philosophies and features of the process design which are aimed at ensuring that the plant performs as required and operates in a safe and environmentally sound manner.

3.4.3.1 General

Figure 3.18 provides a schematic overview of the operating philosophy of the physical/chemical treatment plant.

The key operating features of the physical/chemical treatment system illustrated in Figure 3.18 are summarized as follows:

- The physical/chemical treatment plant will initially operate 8 hours per day 5 days per week 50 weeks per year. Additional shifts will be worked as the waste quantities increase.

- All surface drainage from the central operating area and potentially contaminated drainage from the landfill will be collected and analyzed to determine whether treatment is required. Landfill leachate will also be monitored to determine whether it requires treatment. If treatment is required and the quantities involved are small, these wastes can be treated batchwise in the inorganic waste treatment system. Otherwise, these wastes will be treated in the miscellaneous waste treatment system.

- In the event that a large volume of surface drainage becomes contaminated and must be treated, the miscellaneous waste treatment system will be operated continuously (24 h/d) until the problem is resolved.

- Sample analyses and treatability test information will be used to establish treatment recipes for wastes prior to physical/chemical treatment.

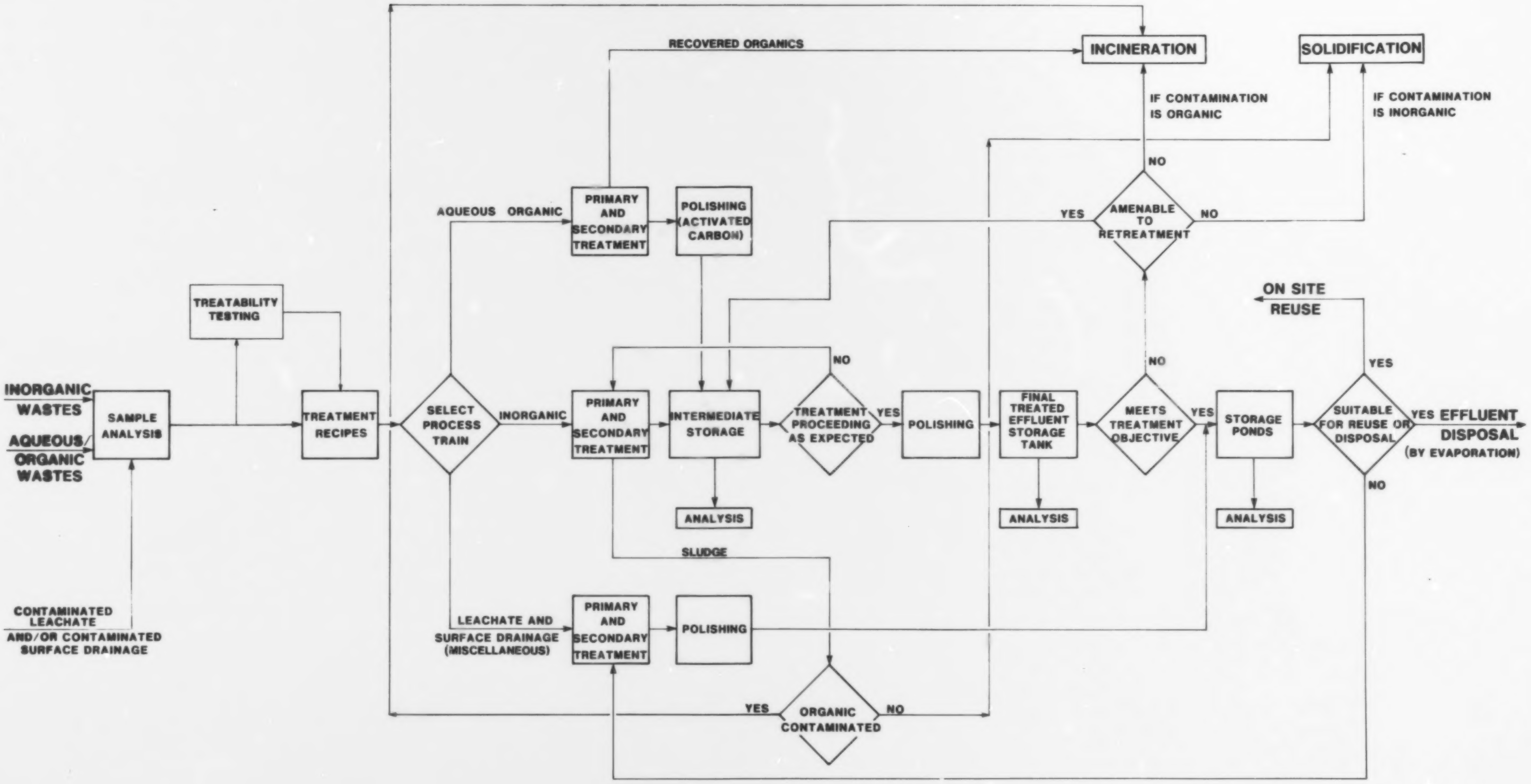

INORGANIC WASTES
AQUEOUS/ORGANIC WASTES
CONTAMINATED LEACHATE AND/OR CONTAMINATED SURFACE DRAINAGE
SAMPLE ANALYSIS
TREATABILITY TESTING
TREATMENT RECIPES
SELECT PROCESS TRAIN
AQUEOUS ORGANIC
INORGANIC
LEACHATE AND SURFACE DRAINAGE (MISCELLANEOUS)
PRIMARY AND SECONDARY TREATMENT
POLISHING (ACTIVATED CARBON)
RECOVERED ORGANICS
PRIMARY AND SECONDARY TREATMENT
INTERMEDIATE STORAGE
ANALYSIS
TREATMENT PROCEEDING AS EXPECTED
NO
YES
POLISHING
FINAL TREATED EFFLUENT STORAGE TANK
ANALYSIS
MEETS TREATMENT OBJECTIVE
NO
YES
AMENABLE TO RETREATMENT
YES
NO
NO
INCINERATION
IF CONTAMINATION IS ORGANIC
SOLIDIFICATION
IF CONTAMINATION IS INORGANIC
STORAGE PONDS
ANALYSIS
SUITABLE FOR REUSE OR DISPOSAL
YES
ON SITE REUSE
YES
EFFLUENT DISPOSAL (BY EVAPORATION)
NO
SLUDGE
PRIMARY AND SECONDARY TREATMENT
POLISHING
ORGANIC CONTAMINATED
YES
NO

FIGURE 3.18
PHYSICAL/CHEMICAL TREATMENT PLANT OPERATING PHILOSOPHY SCHEMATIC

- The physical/chemical treatment processes have been designed to achieve a staged reduction in contaminant concentrations through primary treatment, secondary treatment and effluent polishing.

- Quality control checks will be carried out during the treatment sequence to ensure that treatment is proceeding as planned.

- Quality control checks will be carried out after treatment to confirm that the treated effluent is suitable for reuse or discharge.

- The physical/chemical treatment systems are designed and will be operated to enable treated effluents to be reused on site to the maximum extent possible.

- Treated effluents which fail to meet the required treatment objective for either reuse or discharge to atmosphere by evaporation may either be:
  - retreated in the physical/chemical treatment plant,
  - solidified if the residual contaminants are inorganic in nature, or
  - incinerated if the residual contaminants are organic in nature.

3.4.3.2 Treatability Testing

Operation of the physical/chemical treatment plant is based on the requirement that each treatment step will be determined in advance based on the results of laboratory scale treatability tests. No waste will be treated unless test data are available which specify the optimum combination of treatment steps required to produce the desired effluent quality and which demonstrate that the desired effluent quality can be achieved.

Batches of waste destined for physical/chemical treatment will have a treatment recipe assigned in advance of arrival at OWMC's Facility based on tests which have been carried out on prior samples obtained from the waste generator. Once an optimum treatment recipe has been developed for each generator's waste, the same recipe will be applied wherever possible to successive batches of waste from the same generator. Additional treatability testing will be done only if the "fingerprint" analyses indicate either a change in waste characteristics has occurred which would not be accommodated by the established treatment recipe or, if the established treatment recipe had failed to produce satisfactory results for the previous batch of waste treated. All wastes will be subjected to "fingerprint" analysis on arrival at the Facility.

Additional treatability tests will also be carried out in advance of mixing any two potentially compatible wastes together to ensure that the operation can be done safely, to verify that the treatability of the combined waste is not adversely affected and to establish the optimum treatment recipe for the combined waste.

The physical/chemical laboratory will assign the appropriate treatment recipe for each batch of waste stored in the physical/chemical storage tank area. The treatment recipe will provide the physical/chemical treatment plant operators with the following information:

- Location of waste in the physical/chemical storage tank area.
- Size of batch and type of waste.
- The treatment steps to be applied to the waste and in what order.
- The type and quantity of reagents to be added at each stage of the treatment process and in what order.
- Key control parameters which must be maintained during each stage of the treatment process such as reaction times, settling times, pH, oxidation/reduction potential, and temperature.

- The types of analyses which must be carried out at intermediate stages of treatment to verify that treatment is proceeding as expected.

- Special operating procedures or safety precautions which must be observed during the handling and treatment of a particular batch of waste.

- Special emergency procedures which must be followed in the event of a spillage.

- Special requirements for flushing waste transfer lines after transferring a particular batch from storage to treatment.

Once the physical/chemical treatment plant operators have received the treatment recipe for a particular waste, they will schedule its treatment in a safe manner consistent with achieving the most effective use of equipment and which will enable them to monitor each batch through the various stages of treatment.

3.4.3.3 Process Control Philosophy

The physical/chemical treatment plant process control system will provide the plant operators with the flexibility to control major items of process equipment including associated pumps and valves either centrally from the control room in the physical/chemical building or locally from a position at the equipment itself depending on the operating function being carried out.

The physical/chemical treatment plant control philosophy has been developed in accordance with the following general principles:

- For maximum safety, efficiency and reliability, operation of all valves and pumps to transfer waste from storage tanks to the reaction tanks, including line flushing where required, are controlled and monitored from the control room.

- For efficiency and convenience, the reaction tanks will be controlled locally.

- Operation of all valves which determine the direction and destination of waste flows through subsequent stages of physical/chemical treatment will be controlled and monitored from the control room.

- The ability for local start and stop is provided for all mechanical equipment. Local start functions are only permitted by a signal from the control room.

- Local operations will be co-ordinated and monitored from the control room for maximum safety, efficiency and reliability.

The following points summarize the remaining key features of the control philosophy which apply to all treatment processes in the physical/chemical treatment plant.

- The control room is located in a central location on the second floor of the building between the physical/chemical and solidification process areas.

- The process control equipment is a micro processor based distributed control system. The data management system is a central computer system with distributed intelligent access.

- All treatment functions and waste transfer operations are operator initiated using a keyboard interface. Process monitoring is by television monitors (CRTs).

- All waste treatment recipes will be stored in the data management system for display on the CRTs.

- All alarm conditions are indicated by audible and visible annunciation in the control room via the CRT display.

- Local alarm annunciation is provided where there is a possibility of local danger to operating personnel.

- All safety showers are alarmed if activated.

- Key process measurements can be stored short term (24 hours) in the control system or long term in the data management system.

- Feedback signals indicate the start/stop status of all rotating equipment (pumps and agitators) in the control room.

- Feedback signals also show the position (open or closed) of all remote controlled valves in the control room.

- All process control parameters are indicated locally as well as in the control room.

- Trend recorders are available and a process measurement such as pH can be connected to one of these if desired.

- Printers for generating hard copies of reports and information such as waste treatment recipes are available in the control room.

3.4.3.4 Operational Safety

The following operational safety features have been included in the design and operation of the physical/chemical treatment plant to ensure that it is capable of being operated with minimal risk to occupational health and the environment during operation:

- All waste storage, process reagent storage and treatment processes within the physical/ chemical building are carried out in vessels which are totally enclosed and vented. Vented air is scrubbed before it is discharged from the physical/chemical building to the atmosphere.

- Storage tanks and reaction tanks will be under slight negative pressure due to the ventilation system. This prevents fugitive gaseous emissions from escaping into the building.

- The top inspection hatches on each reactor remain closed during the treatment sequence. Sampling is carried out from sampling valves designed to minimize the risk of operator exposure to the tank contents.

- A separate booster fan is provided in the ventilation duct from each reaction tank. This fan starts automatically if the inspection hatch is opened during the reaction sequence thus ensuring that fumes and vapours do not escape from the tank to endanger the operator.

- The main ventilation air fans are duplicated to guard against mechanical failure and the entire ventilation air collection and scrubbing system are connected to the emergency power supply to maintain full ventilation capability during power outages.

- The physical/chemical building is ventilated separately from the process equipment and tanks. Therefore, any gaseous emissions which escape the process fume and dust collection system are removed from the physical/chemical plant by the general building ventilation system.

- The physical/chemical control room is internally pressurized with a separate clean air supply.

- Process reagent storage tanks and transfer pumps are housed in separate enclosed and ventilated areas inside the physical/chemical building. This approach has been adopted for the following reasons:
  - to ensure that reagents are contained in the event of spills or leaks and that spills or leaks of potentially incompatible reagents are kept segregated.

- to ensure that fugitive dusts, odours and fumes are contained and kept segregated from the remainder of the physical/chemical building.

3.4.4 ABNORMAL OPERATION OR UPSET CONDITION

The following outlines the physical/chemical treatment plant operating philosophies, safety features and emergency procedures of the process design which are aimed at containing and minimizing the effects resulting from abnormal operation or upset conditions.

3.4.4.1 Spills and Leaks

- Minor spills or leaks from process tanks and pump seals will be contained for clean-up by curbs around the base of the equipment. In addition, pumps are equipped with an integral base plate/drip pan.

- An overflow collection tank is provided for each group of six waste storage tanks to contain spillages in the event of failure of the tank level control and alarm systems during waste transfer operations. The six tanks within the group will contain compatible wastes.

- Large spillages resulting from tank rupture or overfilling will be collected in segregated sumps also designed to collect floor washwater. Any such spills will be contained within the physical/chemical building. Alarms will alert the operators that a spillage has occurred.

3.4.4.2 Power Failure

- The plant control and status monitoring system is connected to an uninterruptible power supply as soon as the power fails. The ventilation fans and ventilation air scrubbing systems are connected to the emergency power supply.

- On return of normal power, all systems will be restarted in an orderly sequence by the plant operators.

3.4.4.3 Fire

- Areas of the physical/chemical building which store or treat potentially flammable aqueous/organic mixtures are protected by foam fire protection systems which activate automatically in the event of a fire.

- Fire walls are provided between organic and inorganic treatment systems.

- The inorganic waste storage and physical/chemical processing areas are protected by a sprinkler system.

- The control room is protected by a "Halon" gas fire extinguishing system.

3.4.4.4 Additional Safeguards

- Gas analyzers sample the ventilated air from each reaction tank for the presence of toxic gases (eg. hydrogen cyanide and hydrogen sulphide). An alarm will alert the operators of a potential upset condition which has resulted in gas formation.

- All inorganic waste storage tanks are equipped with temperature indicators and remote alarms to warn the operators in the event that incompatible wastes have been mixed causing an exothermic reaction.

- Emergency eyewash and shower stations are provided at strategic locations at all levels in the physical/chemical building.

- Emergency escape routes are provided from the top floor via four access stairways located in each corner of the physical/chemical building or via the solidification building.

3.4.5 TYPICAL TREATMENT SEQUENCE

The following paragraphs illustrate the manner in which a typical waste will likely be treated from the time of its arrival at OWMC's Facility until the completion of physical/chemical treatment. Figure 3.13 is a pictorial flow diagram that shows the physical/chemical treatment systems. For discussion purposes, it is assumed that the waste to be treated is sludge from a metal plating waste treatment facility which contains cyanide, heavy metals including hexavalent chromium and minor amounts of unspecified dissolved organics (less than 1%). The sludge is also assumed to be in the form of a non-pumpable filter cake containing 30% solids (70% moisture) and has been shown, by laboratory scale solidification and leach testing to require physical/chemical treatment prior to solidification and landfilling.

Prior to its arrival at the Facility, detailed analysis and if necessary, treatability testing, will have been carried out on samples of the sludge. If similar waste from the same generator had been treated previously at the Facility, the treatment recipe which had already been developed for this waste will be reused. Additional treatability tests will be carried out only if the characteristics of the waste to be treated were significantly different from those of the previous batch.

On its arrival at the Facility, a sample of the waste will be obtained for "fingerprint" analysis to verify its identity. Once cleared, the truck will be directed to the proper unloading station.

As a first step in the treatment process, the waste will be reslurried using recycle water to a consistency of 5 to 15% solids by weight to render it pumpable and make it suitable for subsequent physical/chemical processing. This will be carried out in the unloading basin during the unloading process or, if size reduction is required, in the solidification plant. The resulting dilute sludge mixture will then be transferred to one or more of the waste storage tanks to await subsequent treatment.

From the waste storage tanks, the mixture will be transferred into one or more of the oxidation/reduction reactors to start the secondary treatment processes. First, cyanide oxidation will take place to destroy free and complexed cyanides in the sludge mixture. This will be accomplished by adjusting the pH of the mixture (likely to around pH 10 or 10.5) and adding the appropriate quantity of sodium hypochlorite. All reagent additions will be initiated locally by the reactor operator.

Reagent dosages and reaction conditions (pH, oxidation potential and reaction time) will be dictated by the treatment recipe and set by the reactor operator. Second stage oxidation of cyanate to nitrogen and carbon dioxide will then be carried out by reducing the pH of the mixture (likely to around pH 8.5 with sulphuric acid) and adding additional sodium hypochlorite. Again, the actual reagent dosages and reaction conditions used will be determined from the treatment recipe. At the completion of the cyanide oxidation step, a sample of the mixture will be obtained for laboratory analysis to verify that treatment was proceeding as expected.

Following cyanide oxidation, the pH of the mixture will be reduced to approximately pH 2.0 with sulphuric acid, and sodium bisulphite will be metered into the reaction tank in accordance with the treatment recipe to reduce hexavalent chromium to trivalent chromium. This will be carried out in the same reactor. After the prescribed reaction time, a sample of the waste will be collected for laboratory analysis to verify that the chromium reduction step has proceeded to completion.

Following chromium reduction the pH of the mixture will be raised (likely to between 8 and 9.5 depending on the treatment recipe) to precipitate trivalent chromium and other dissolved heavy metals as metal hydroxides. This neutralization/precipitation reaction will be carried out using either lime, sodium hydroxide or both depending on the treatment recipe. If the treatment recipe indicated the need for additional precipitation steps using sodium hydrosulphide and/or ferric chloride, then these steps will also be carried out in the same reactor.

At the completion of the precipitation reactions, flocculation and solids separation steps will be carried out. If possible, these steps will also be carried out in the same oxidation/reduction reactor. However, if this reactor was required for processing subsequent batches of waste, then the sludge mixture will be pumped into the sludge thickening tanks for flocculation and solids separation. These steps will involve adding the appropriate dosage of polyelectrolyte to the waste mixture, stirring for a specified period of time and then allowing the flocculated solids to settle to produce a clear supernatant and a thickened sludge. If necessary, the partially thickened sludge will then be transferred into one of the sludge thickening tanks for further settling prior to dewatering and the clear supernatant will be transferred into one of the intermediate storage tanks prior to final polishing.

The thickened sludge from the sludge thickening tanks will be pumped through one of three sludge filters to produce a treated filter cake suitable for solidification and landfilling. The filtrate from the sludge filters will be added to the clear supernatant in intermediate storage. At this point, additional samples will likely be collected from the intermediate storage tank for laboratory analysis to confirm that primary and secondary treatment had been completed as expected based on the treatability tests. If necessary, the contents of the intermediate storage tank can be returned to one of the reaction tanks for additional treatment.

If the organic content of the treated sludge was too high to enable it to be directly solidified and landfilled, the dewatered solids will be discharged into a portable container for treatment by incineration.

Partially treated effluent from the intermediate storage tank will then be polished, first by granular media filtration to remove any finely divided suspended solids which may be present in the supernatant, followed by activated carbon adsorption to remove dissolved organics, organometallic complexes and some stable cyanide complexes (eg. iron cyanide) which may not have been destroyed by chemical oxidation.

Following activated carbon treatment, the effluent will be given final polishing by reverse osmosis (RO) to remove dissolved solids including salts, residual heavy metals, residual metal cyanide complexes and organics. The concentrated rejects from the RO units will either be solidified and landfilled or incinerated depending on the concentrations of organics present. The clean discharge from the reverse osmosis units will be discharged into one of the final effluent storage tanks for final water quality checks before being discharged into the recycle water pond. Excess treated effluent will be discharged from the Facility by evaporation.

3.5 SOLIDIFICATION PLANT

The solidification plant, which is located adjacent to, and north of the physical/chemical treatment plant (see Figure 3.2), accommodates the following systems:

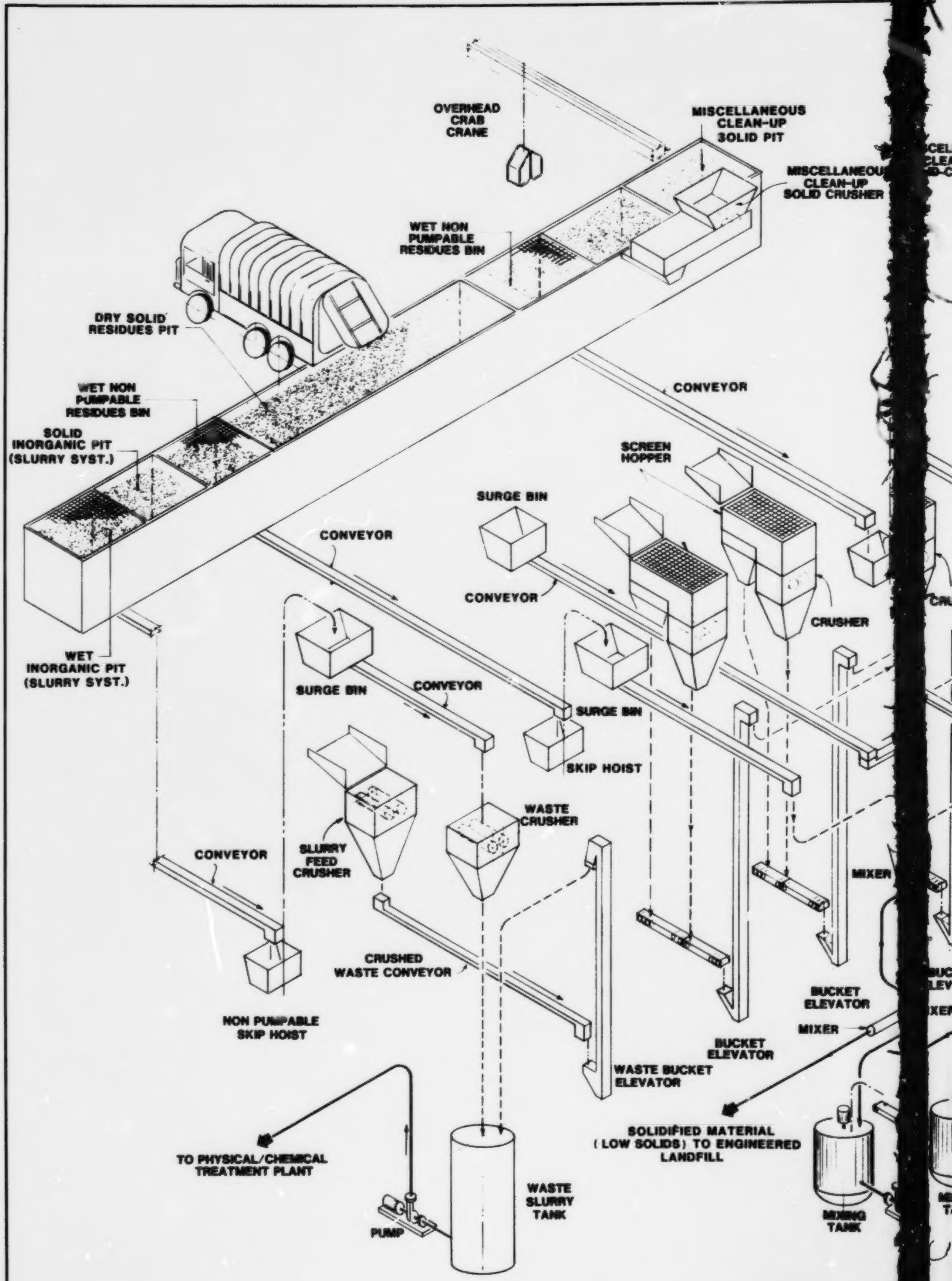
- feed storage and handling,
- high solids treatment system,
- low solids treatment system,
- reagent storage and handling, and
- instruments and controls.

Figure 3.19 provides a pictorial flow diagram of the above systems in the solidification plant and illustrates the main components.

Figures 3.20 to 3.22 provide the conceptual equipment layout in both plan and sectional views of the solidification plant.

3.5.1 FEED STORAGE AND HANDLING

The feed storage and handling system receives, stores and handles filter cake, dry solids and wet non-pumpables from generators and liquid residues and miscellaneous clean-up materials which require treatment in the solidification plant. In addition, dry solids and wet non-pumpable inorganic wastes that require size reduction and slurrying prior to


OVERHEAD CRAB CRANE
MISCELLANEOUS CLEAN-UP SOLID PIT
MISCELLANEOUS CLEAN-UP SOLID CRUSHER
WET NON PUMPABLE RESIDUES BIN
DRY SOLID RESIDUES PIT
WET NON PUMPABLE RESIDUES BIN
SOLID INORGANIC PIT (SLURRY SYST.)
CONVEYOR
SCREEN HOPPER
SURGE BIN
CONVEYOR
CONVEYOR
CRUSHER
WET INORGANIC PIT (SLURRY SYST.)
SURGE BIN
CONVEYOR
SURGE BIN
SKIP HOIST
SLURRY FEED CRUSHER
WASTE CRUSHER
CONVEYOR
MIXER
NON PUMPABLE SKIP HOIST
CRUSHED WASTE CONVEYOR
BUCKET ELEVATOR
MIXER
BUCKET ELEVATOR
WASTE BUCKET ELEVATOR
SOLIDIFIED MATERIAL (LOW SOLIDS) TO ENGINEERED LANDFILL
TO PHYSICAL/CHEMICAL TREATMENT PLANT
WASTE SLURRY TANK
PUMP
MIXING TANK

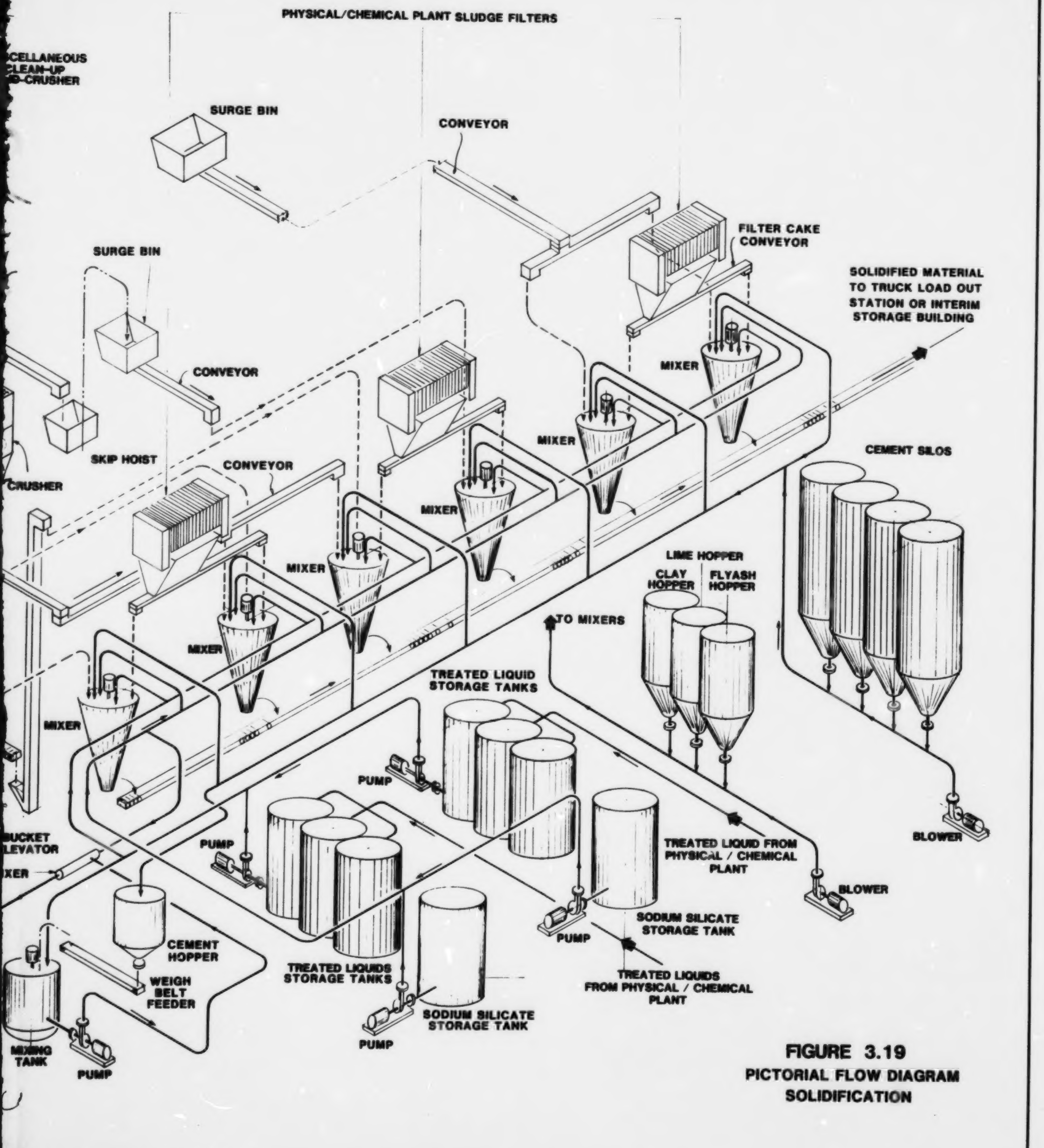
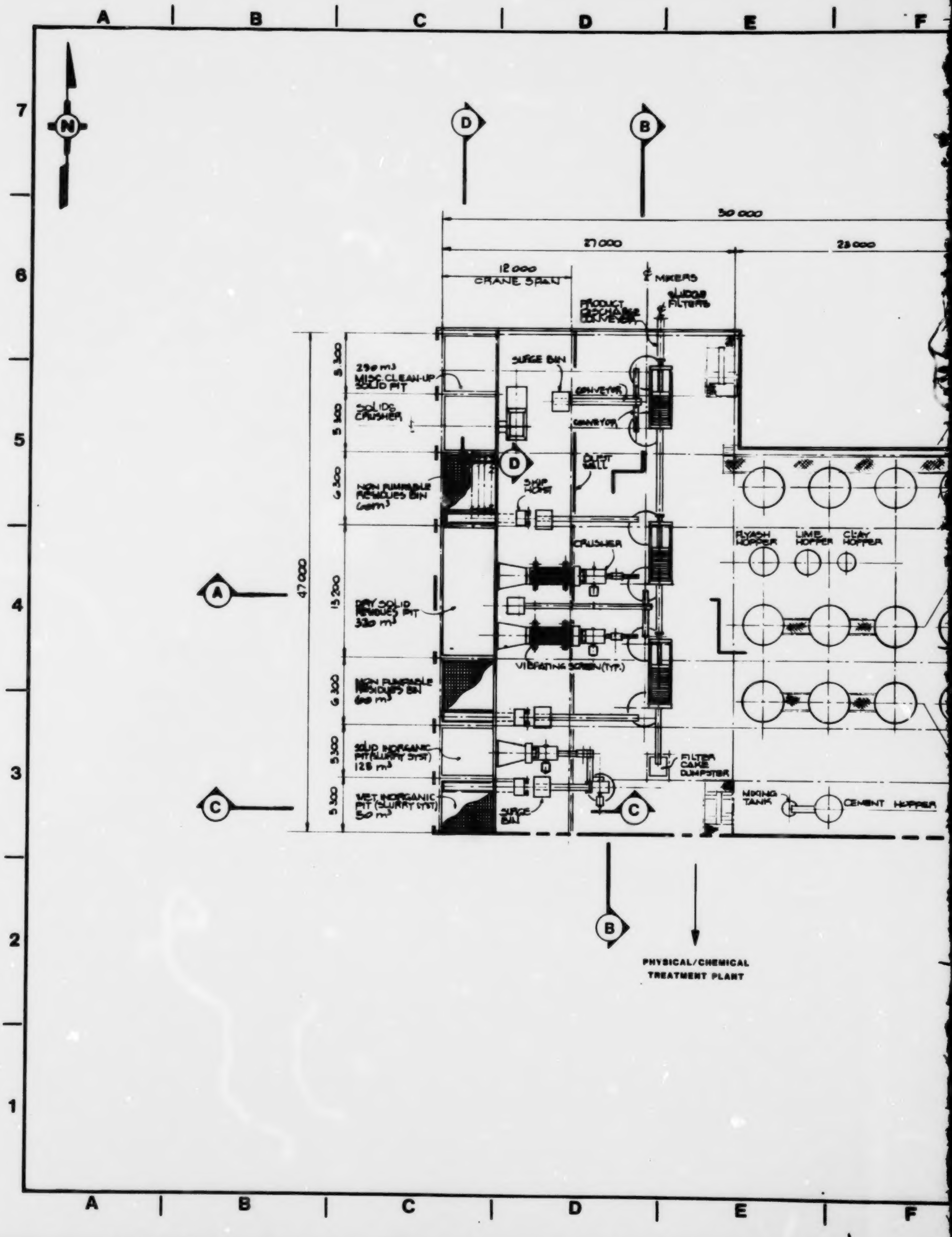
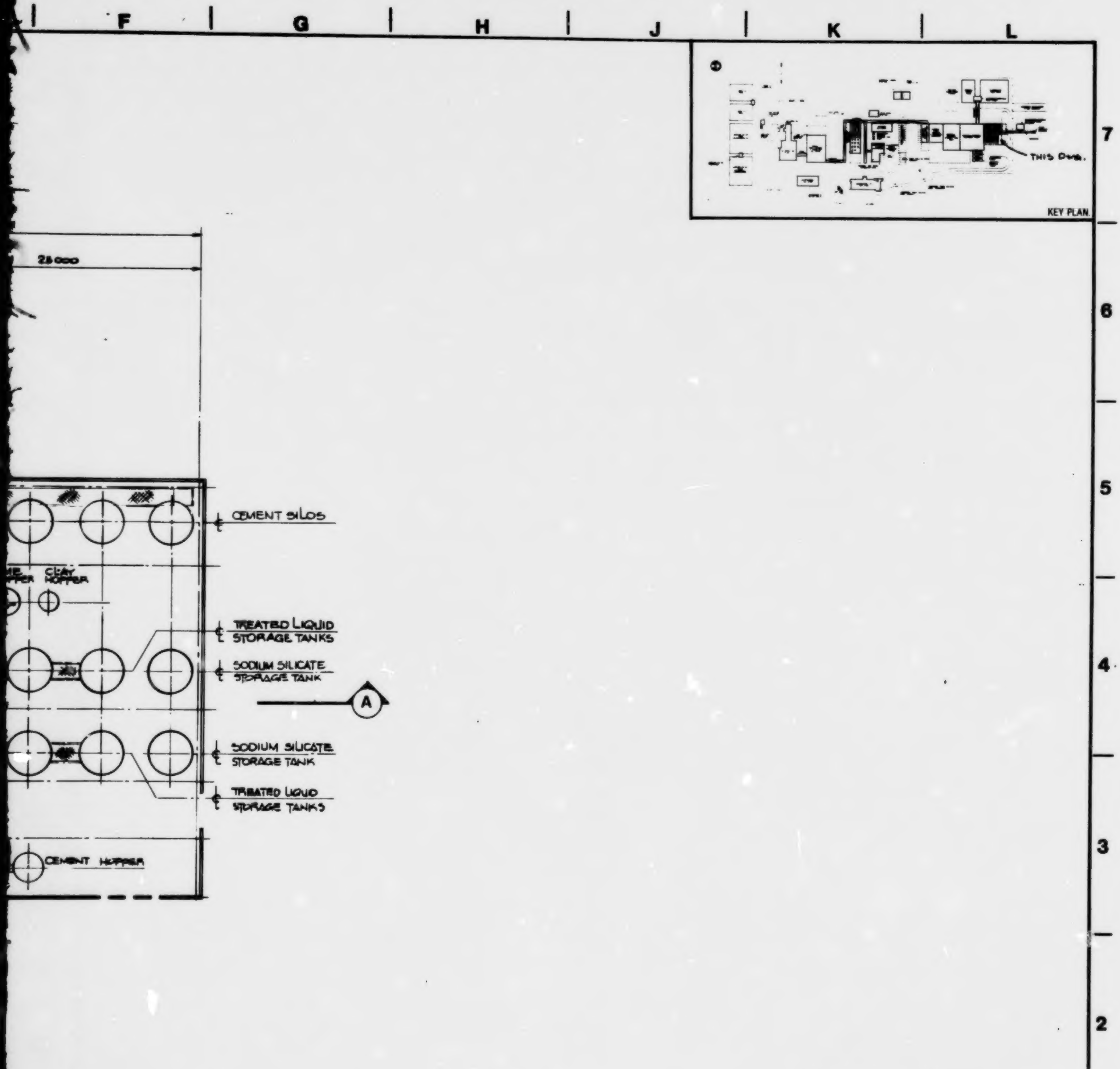

PHYSICAL/CHEMICAL PLANT SLUDGE FILTERS
CELLANEOUS
CLEAN-UP
D-CRUSHER
SURGE BIN
CONVEYOR
FILTER CAKE CONVEYOR
SOLIDIFIED MATERIAL TO TRUCK LOAD OUT STATION OR INTERIM STORAGE BUILDING
SURGE BIN
CONVEYOR
MIXER
MIXER
SKIP HOIST
CONVEYOR
CRUSHER
MIXER
MIXER
MIXER
CEMENT SILOS
LIME HOPPER
CLAY HOPPER
FLYASH HOPPER
MIXER
TO MIXERS
TREATED LIQUID STORAGE TANKS
MIXER
PUMP
BLOWER
UCKET
LEVATOR
XER
PUMP
TREATED LIQUID FROM PHYSICAL / CHEMICAL PLANT
BLOWER
SODIUM SILICATE STORAGE TANK
CEMENT HOPPER
PUMP
WEIGH BELT FEEDER
TREATED LIQUIDS STORAGE TANKS
TREATED LIQUIDS FROM PHYSICAL / CHEMICAL PLANT
SODIUM SILICATE STORAGE TANK
MIXING TANK
PUMP
PUMP

FIGURE 3.19
PICTORIAL FLOW DIAGRAM
SOLIDIFICATION


A
B
C
D
E
F
7
6
5
4
3
2
1
N
D
B
30 000
27 000
23 000
12 000
CRANE SPAN
℄ MIXERS
SLUDGE FILTERS
PRODUCT DISCHARGE CONVEYOR
5 300
5 300
6 300
15 200
6 300
5 300
5 300
47 000
290 m3 MISC CLEAN-UP SOLID PIT
SOLIDS CRUSHER
SURGE BIN
CONVEYOR
CONVEYOR
DUST WALL
NON PUMPABLE RESIDUES BIN 60 m³
SKIP HOIST
CRUSHER
FLYASH HOPPER
LIME HOPPER
CLAY HOPPER
DRY SOLID RESIDUES PIT 320 m³
VIBRATING SCREEN (TYP.)
NON PUMPABLE RESIDUES BIN 60 m³
SOLID INORGANIC PIT (SLURRY SYST) 125 m³
WET INORGANIC PIT (SLURRY SYST) 50 m³
SURGE BIN
FILTER CAKE DUMPSTER
MIXING TANK
CEMENT HOPPER
A
C
C
B
PHYSICAL/CHEMICAL TREATMENT PLANT


F
G
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7
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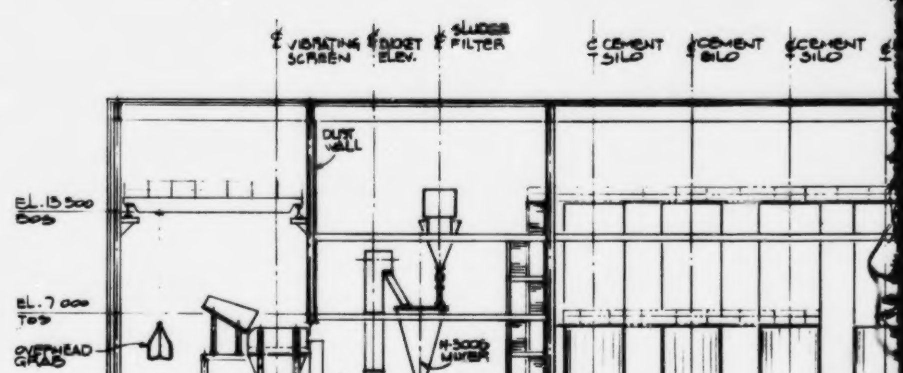
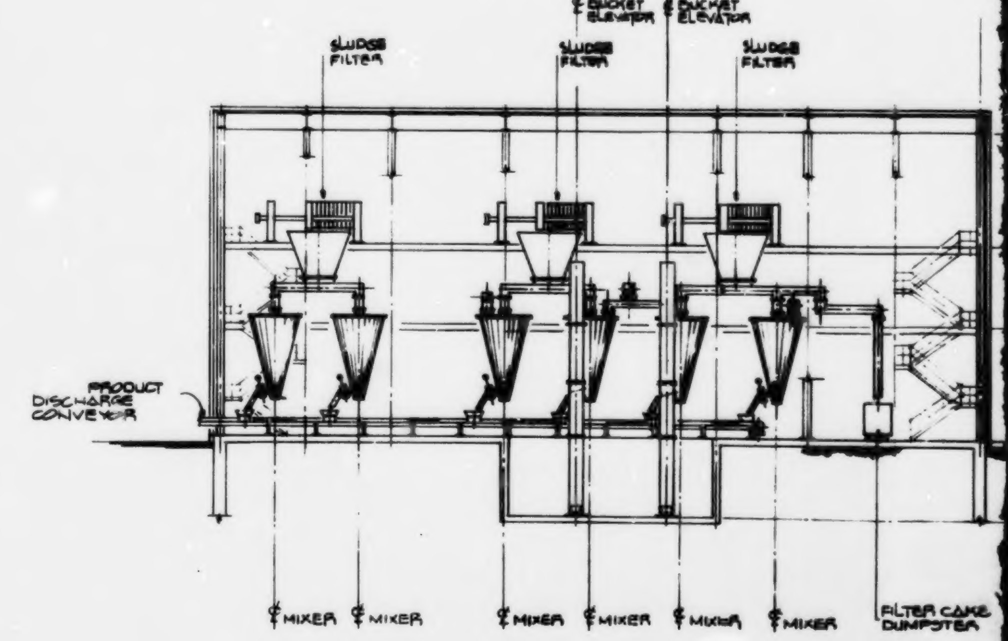
4
3
2
1
THIS DWG.
KEY PLAN
28000
CEMENT SILOS
CLAY HOPPER
TREATED LIQUID STORAGE TANKS
SODIUM SILICATE STORAGE TANK
A
SODIUM SILICATE STORAGE TANK
TREATED LIQUID STORAGE TANKS
CEMENT HOPPER

FIGURE 3.20
SOLIDIFICATION PLANT
EQUIPMENT LAYOUT
PLAN

A | B | C | D | E | F

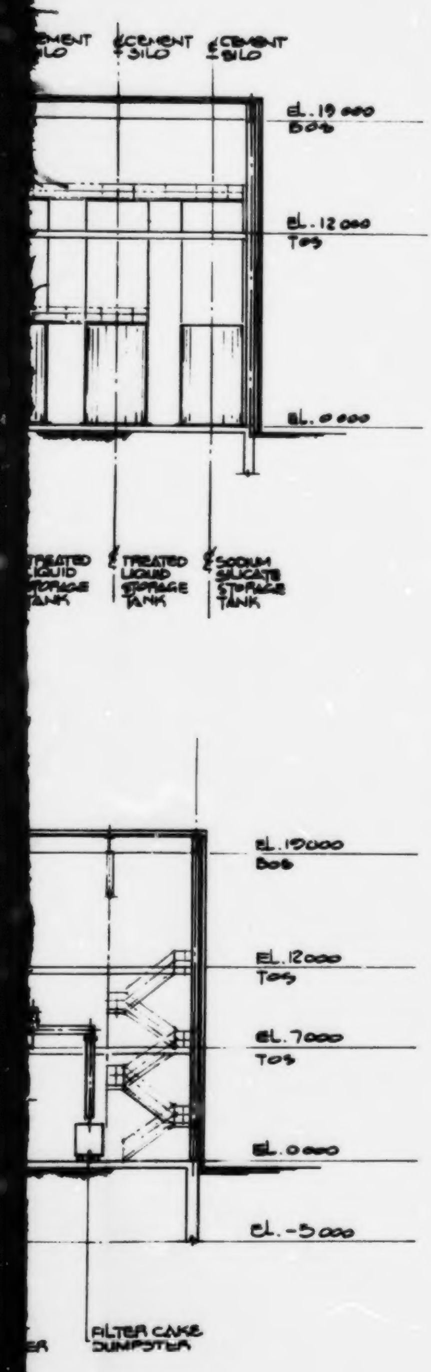

℄ VIBRATING SCREEN
℄ BUCKET ELEV.
℄ SLUDGE FILTER
℄ CEMENT SILO
℄ CEMENT SILO
℄ CEMENT SILO
DUST WALL
EL. 13 500 BOS
EL. 7 000 TOS
OVERHEAD GRAB
H-3000 MIXER
DRY SOLID RESIDUES PIT
℄ CRUSHER
℄ PRODUCT DISCHARGE CONVEYOR
℄ TREATED LIQUID STORAGE TANK
℄ TREATED LIQUID STORAGE TANK
℄ TREATED LIQUID STORAGE TANK

SECTION A-A

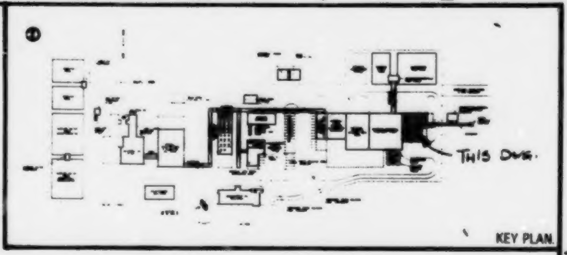

℄ BUCKET ELEVATOR
℄ BUCKET ELEVATOR
SLUDGE FILTER
SLUDGE FILTER
SLUDGE FILTER
PRODUCT DISCHARGE CONVEYOR
℄ MIXER
℄ MIXER
℄ MIXER
℄ MIXER
℄ MIXER
℄ MIXER
FILTER CAKE DUMPSTER

SECTION B-B

A | B | C | D | E | F



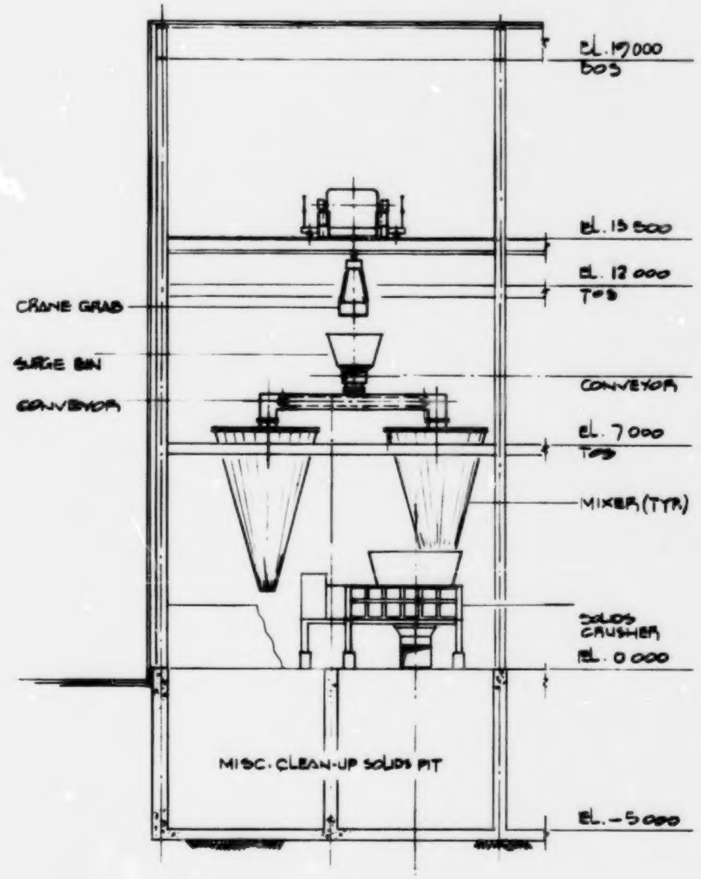
CEMENT SILO
℄ CEMENT SILO
℄ CEMENT SILO
EL. 19 000 BOS
EL. 12 000 TOS
EL. 0 000
TREATED LIQUID STORAGE TANK
℄ TREATED LIQUID STORAGE TANK
℄ SODIUM SILICATE STORAGE TANK
EL. 15000 BOS
EL. 12000 TOS
EL. 7000 TOS
EL. 0 000
EL. -5 000
ER
FILTER CAKE DUMPSTER



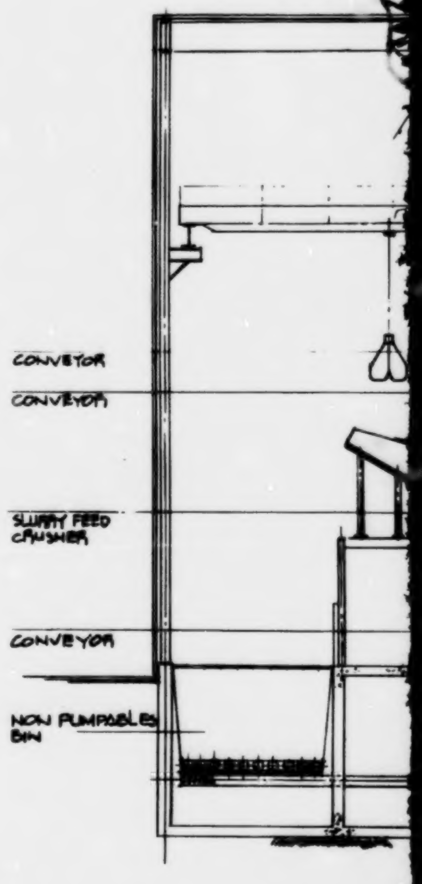
THIS DWG.
KEY PLAN.

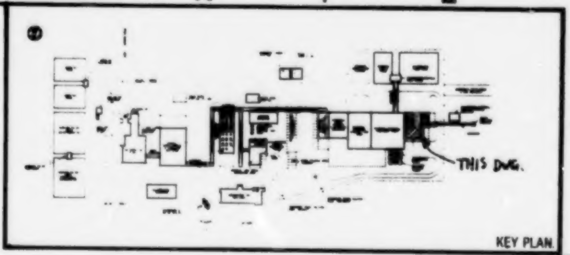
FIGURE 3.21

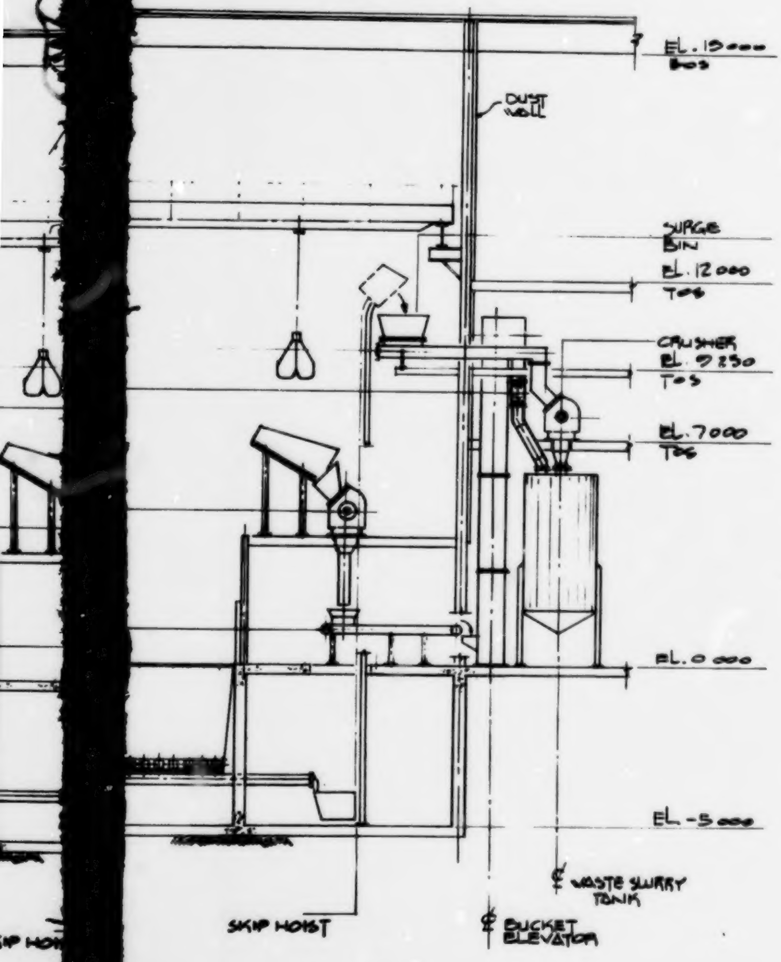
SOLIDIFICATION PLANT
CONCEPTUAL EQUIPMENT LAYOUT
SECTIONS


EL. 17000
BOS
EL. 13500
EL. 12 000
TOS
CRANE GRAB
SURGE BIN
CONVEYOR
CONVEYOR
EL. 7000
TOS
MIXER (TYP.)
SOLIDS
CRUSHER
EL. 0.000
MISC. CLEAN-UP SOLIDS PIT
EL. -5000

SECTION D-D


CONVEYOR
CONVEYOR
SLURRY FEED
CRUSHER
CONVEYOR
NON PUMPABLES
BIN
SKIP HO


THIS DWG.
KEY PLAN.


EL. 15 000
BOS
DUST WALL
SURGE BIN
EL. 12 000
TOS
CRUSHER
EL. 9 250
TOS
EL. 7000
TOS
EL. 0 000
EL. -5 000
℄ WASTE SLURRY TANK
℄ BUCKET ELEVATOR
SKIP HOIST

SECTION C - C

FIGURE 3.22

SOLIDIFICATION PLANT
CONCEPTUAL EQUIPMENT LAYOUT
SECTIONS

treatment in the physical/chemical treatment plant are received, stored and handled in the solidification plant prior to being sent for physical/ chemical treatment.

The various equipment described here are located in the solidification building (see Figures 3.20 to 3.22).

3.5.1.1 Filter Cake

Filter cake originates from the sludge filters of the inorganic waste treatment system (p. 109), and are located on the top floor of the solidification building. The filter cake from each of these sludge filters is collected in dedicated filter cake collection hoppers and then fed to either of two mixers by dedicated reversible sludge filter discharge conveyors located below each filter.

One sludge filter will always handle the inorganic waste from the inorganic waste treatment system that could contain organics. This organic filter cake is discharged from the respective reversible sludge filter discharge conveyor into a dumpster for transferring to the incineration plant for disposal (p. 54).

3.5.1.2 Dry Solids and Wet Non-Pumpable Residues

Dry Solid Residues

Dry inorganic bulk solid residues from generators, which do not require physical/chemical treatment prior to screening and size reduction for treatment in the solidification mixers (p. 148), are received and stored in the dry solid residue pit. The pit has a capacity of 320 m^3 and is divided into compartments to provide segregation of dry residue batches depending on their characteristics.

The dry solid residues are transferred from the pit to the screening and size reduction equipment using the overhead grab crane. There are two screening and size reduction trains, each with a capacity of 15 t/h and each consisting of:

- a screen hopper which screens out oversize solid residues (greater than 25 mm),

- a crusher which crushes the oversize solid residues to less than 25 mm,

- a conveyor which conveys the undersize residues from the screen hopper and the crushed residues from the crusher to a bucket elevator, and

- a bucket elevator which receives dry solid residues from the screening and size reduction train, elevates it and then discharges into a solidification mixer (p. 148).

Wet Non-Pumpable Residues

Wet non-pumpable residues from generators, which do not require physical/chemical treatment prior to treatment in the solidification mixers (p. 148), are received and stored in one of two wet non-pumpable residues bins .

Each of the bins has a capacity of 60 m^3 and has a live bottom, discharging via a screw conveyor into a skip hoist. The skip hoist has a capacity of 15 t/h and elevates the wet non-pumpable residues to discharge into a surge bin (of 2 m^3 capacity) which is then conveyed by a conveyor (of 15 t/h capacity), and discharged into a solidification mixer (p. 148).

3.5.1.3 Liquid Residues

Treated Liquid Storage Tanks

Six 65 m^3 capacity treated liquid storage tanks are provided to receive treated effluent from the treated effluent storage tanks of the inorganic waste treatment system (p. 113), prior to treatment in the low solids treatment system. Three of the treated liquid storage tanks can also receive treated liquids from the physical/chemical treatment processes as follows:

- treated liquid from the intermediate storage tanks of the inorganic waste treatment system (p. 109),
- evaporator blowdown (p. 113), and
- treated liquid from the reverse osmosis reject tank (p. 112).

These three treated liquid storage tanks also have the flexibility to discharge to both the low and high solids treatment systems.

3.5.1.4 Miscellaneous Clean-Up Material

Miscellaneous clean-up material brought to the Facility but which does not require physical/chemical treatment, is received and stored in one compartment of the miscellaneous clean up solids pit prior to treatment in the solidification mixers (p. 148). The pit has a capacity of 250 m^3 and is equipped with a solids crusher for size reduction and which discharges into the second compartment.

The overhead grab crane, associated with the feed storage and handling system, feeds the crusher with material (for size reduction if required) and then transfers the material to one of two miscellaneous clean-up solids surge bins.

Each surge bin discharges onto a conveyor which conveys the material to one of two solidification mixers (p. 148).

In addition, the system has the flexibility to transfer dry solids from either the dry solid residue pit or the miscellaneous clean up solids pit to the wet non-pumpable residues surge bins or the miscellaneous clean up solids surge bins using the overhead grab crane. This enables any of the solidification mixers to be supplied with solids during times when crushing and conveying systems, associated with that mixer feed system, are out of operation.

3.5.1.5 Dry Solids and Wet Non-Pumpable Inorganic Wastes

Dry Solids Inorganic Wastes

Dry solids inorganic wastes from generators which require treatment in the physical/chemical treatment plant and have to be crushed/slurried are received and stored in the solids inorganic pit, which has a capacity of 125 m^3, prior to slurrying for treatment in the physical/chemical treatment plant.

The overhead grab crane, is used to transfer the dry solid wastes from the solids pit to the slurry feed crusher for size reduction prior to slurrying the waste.

The slurry feed crusher has a capacity of 3 t/h and discharges onto the crushed waste conveyor which in turn discharges into the crushed waste bucket elevator.

The crushed waste bucket elevator, elevates the waste for discharge into the waste slurry tank. The tank is equipped with an agitator for slurrying the crushed waste, using process water.

In addition, the waste slurry tank can receive crushed wet non-pumpable inorganic wastes for slurrying.

After slurrying, the inorganic waste is pumped to the neutral/alkaline waste designated tanks in the physical/chemical storage tank area, prior to treatment (p. 177).

Wet Non-Pumpable Inorganic Wastes

Wet non-pumpable inorganic wastes from generators, which require treatment in the physical/chemical treatment plant and have to be crushed/slurried are received and stored in the non-pumpables bin prior to slurrying for treatment in the physical/chemical treatment plant.

The non-pumpables bin has a capacity of 50 m^3 and has a live bottom, discharging via a screw conveyor into the non-pumpables skip hoist. The skip hoist has a capacity of 1 t/h and elevates the wet non- pumpable waste to discharge into a wet waste crusher.

The wet waste crusher has a capacity of 1 t/h and discharges the crushed waste into the waste slurry tank, where it is slurried with or separate from dry solids, and finally pumped to the waste storage tanks for storing neutral/alkaline wastes in the physical/chemical storage tank area, prior to treatment (p. 177).

3.5.2 HIGH SOLIDS TREATMENT SYSTEM

There are two high solids treatment systems, one located at the incineration plant to treat solid residues from the waste heat recovery boiler, spray dryer and electrostatic precipitator as described in Section 3.3.2.6 (p. 76) and one located in the solidification plant as described in this Section to solidify selected residues from the waste generators facilities which do not require physical/chemical treatment, high solid residues from the physical/chemical treatment plant and blowdown from the evaporator. These residues are stored and handled as described in Section 3.5.1 (p. 139).

The high solids treatment system (located in the solidification plant) comprises mixers and a product discharge conveyor.

3.5.2.1 Mixers

There are a number of different types of mixers (eg. pug mills, cone mixers, cement mixers etc.) which can be used and a preliminary evaluation of these types of mixers suggested that cone mixers may be the most appropriate type of mixer for this application. The type of mixer used will be determined during detailed engineering, following further investigations.

Six mixers, each with a capacity of 7.3 m^3 are provided for mixing residues. Each mixer is capable of treating an average of 6.5 t of residue per batch, producing approximately 9.5 t of solidified material.

The solidification mixers, which are located in the solidification building (see Figure 3.21), receive residues as follows:

- filter cake from the sludge filters (p. 109),
- dry solids and wet non-pumpable residues (pp 144, 145)
- liquid residues from the treated liquid storage tanks(p. 145), and
- miscellaneous clean-up material (p. 146).

The mixers are mounted on load cells to accurately weigh the quantities of materials entering the mixer. Provision is made for the addition of reagents and additives (Portland cement, sodium silicate, lime, flyash and water) sequentially on a weight basis to satisfy the predetermined forumulations. Where water is required to be added, process water from the treated liquid storage tanks (p. 145) is used. A total of 30 minutes has been allowed for completion of loading operations for each mixer batch.

3.5.2.2 Product Discharge Conveyor

After the mixing stage is complete, the contents of the mixers are dischaged onto a discharge conveyor for transportation to the truck load out-station or the solidified material interim storage building (see Section 3.6.3.1, p. 164). Thirty minutes has been allowed for the discharge operation.

The product discharge conveyor is located below the discharge chutes from the mixers (see Figure 3.21).

3.5.3 LOW SOLIDS TREATMENT SYSTEM

The low solids treatment system treats pumpable inorganic treatment residues from the treated liquid storage tanks (p. 145) in batches, using Portland cement and sodium silicate as the main solidification additives. The equipment associated with the low solids treatment system is located in the solidification building (see Figure 3.20).

Pumpable inorganic treatment residues are pumped from one of the treated liquid storage tanks to the mixing tanks at a rate of approximately 65 m^3/h, using the treated liquid feed pump.

Portland cement is metered from a day hopper into the mixing tank by a weigh belt feeder. The treated liquid and Portland cement is mixed thoroughly to form a slurry, in the mixing tank, equipped with two high shear mixing agitators.

From the mixing tank, the low solids discharge pump pumps the slurry through a pipeline mixer (where sodium silicate is added) to the engineered landfill at a rate of up to 70 m^3/h.

Portland cement is stored in a cement hopper of 6 t capacity, which is filled from cement silos in the reagent storage and handling system (see Section 3.5.4). The cement hopper feeds Portland cement to the mixing tank at a rate up to 8 t/h.

Sodium silicate is fed to the pipeline mixer from sodium silicate tanks in the reagent storage and handling system.

3.5.4 REAGENTS STORAGE AND HANDLING

Reagents that are required for the solidification processes are:

- Portland cement, and
- (soluble) sodium silicate solution.

Additives that are required for the solidification processes include:

- lime,
- clay, and
- flyash.

The equipment associated with reagent storage and handling is located in the solidification building (see Figures 3.20 to 3.22).

3.5.4.1 Portland Cement

Portland cement is received in bulk by trucks which discharge to one of four 120 t nominal capacity cement silos pneumatically, using the blower mounted on each truck.

Each silo is equipped with a dust collector, to control cement dust during filling and emptying operations. A rotary discharge valve permits the cement to be discharged by pneumatic conveyance to the cement hopper of the low solids treatment system (p. 150) or the mixers of the high solids treatment system (p. 148) using one of the two cement blowers provided.

3.5.4.2 (Soluble) Sodium Silicate Solution

Sodium silicate solution is received in bulk by trucks which discharge to one of two 100 m^3 nominal capacity sodium silicate tanks using the pump mounted on each truck.

The sodium silicate solution is pumped to the pipeline mixer of the low solids treatment system (p. 150) and the mixers of the high solids treatment system (p. 148) using one of the two 4.8 m^3/h capacity sodium silicate transfer pumps.

3.5.4.3 Lime

Hydrated lime ($Ca(OH)_2$) is received in bulk by truck which discharges to the 10 t nominal capacity lime hopper pneumatically using a blower mounted on the truck.

The hopper is equipped with a dust collector, to control dust during filling and emptying operations. A rotary discharge valve permits lime to be discharged by pneumatic conveyance to the mixers of the high solids treatment system (p. 148) using one of the two additive blowers provided.

3.5.4.4 Clay

Fine powdered clay is received in bags which are manually emptied into a packaged bag unloader and pneumatically transferred to the 18 t nominal capacity clay hopper.

The hopper is equipped with a dust collector, to control clay dust during filling and emptying operations. A rotary discharge valve permits clay to be discharged for pneumatic conveyance to the mixers of the high solids treatment system (p. 148) using one of the two additive blowers provided.

3.5.4.5 Flyash

Flyash is received in bulk by truck which discharges to the 18 t nominal capacity flyash hopper using a blower mounted on the truck.

The hopper is equipped with a dust collector, to control flyash dust during filling and emptying operations. A rotary discharge valve permits flyash to be discharged for pneumatic conveyance to the mixers of the high solids treatment system (p. 148) using one of the two additive blowers provided.

3.5.5 INSTRUMENTS AND CONTROL

The process control system for the solidification plant is located in a central control room. The solidification plant operation is controlled and coordinated from this central location, where the operator also has access to the data management system for treatment instructions, residue characteristics and solidified material characteristics (for quality control purposes). This ensures that operations within the solidification plant are co-ordinated in a safe manner.

Local operation of the plant, with central coordination from the control room is possible since provision is made for the following:

- all mechanical equipment have emergency stop buttons at the equipment,

- ability for local start and stop is provided for all mechanical equipment,

- there is limited grouping of local start and stop facilities to suit the relative locations/elevations of equipment,

- local indication/readout are located where practical to suit local start/stop groupings,

- responsibility to "permit" local start is at the control room, and

- interlock logic is operable under both local and control room operation.

The grab crane is operated from a cab located at a high elevation so that the pits that the crane grab is servicing can be visually monitored.

Control, process data acquisition and alarm annunciation are handled by the process control system and functions include:

- control of all process parameters,
- interlocks in the materials handling systems,
- process parameters indication,
- alarm annunciation, and
- process trend and alarm report generation.

All flows and levels which are controlled in the automatic mode, and indicating instruments which provide input to manual mode operation, are backed-up by pre-alarm and shut down systems to guard against malfunction of controllers and/or operator error.

3.5.6 NORMAL OPERATION

The following describes the operating philosophy that has been established for the solidification plant.

3.5.6.1 General

Figure 3.23 provides a schematic overview of the operating philosophy of the solidification plant. The key operating features of the plant are summarized as follows:

- The solidification plant will initially operate - 8 hours per day, 5 days per week. Additional hours will be worked as the waste quantities increase up to a maximum of 24 hours per day, 5 days per week.

- In the event that a large volume of treated liquids from the physical/chemical treatment plant cannot be discharged by evaporation and must be solidified, the low solids treatment system will be operated continuously (24 h/d) until the liquid inventory is exhausted.

- Sample analyses and treatability testing will be carried out to establish treatment recipes for residues prior to solidification.

- Inorganic residues from the waste generator's facilities will be analysed to establish the need for physical/chemical treatment. If analysis indicates the need for physical/chemical treatment, the batch will be routed to the physical/chemical treatment plant after size reduction (if necessary) and slurrying. If physical/chemical treatment is not required, the batch will follow the sequence of operations as for treated residues.

- Optimum solidification recipes, as established by treatability tests, will be used for the solidification of residues.

- Based on the nature of the batch of residue, it will be solidified in the high solids system or low solids system.

- Quality control/checks will be carried out in accordance with the testing protocol established for the Facility.

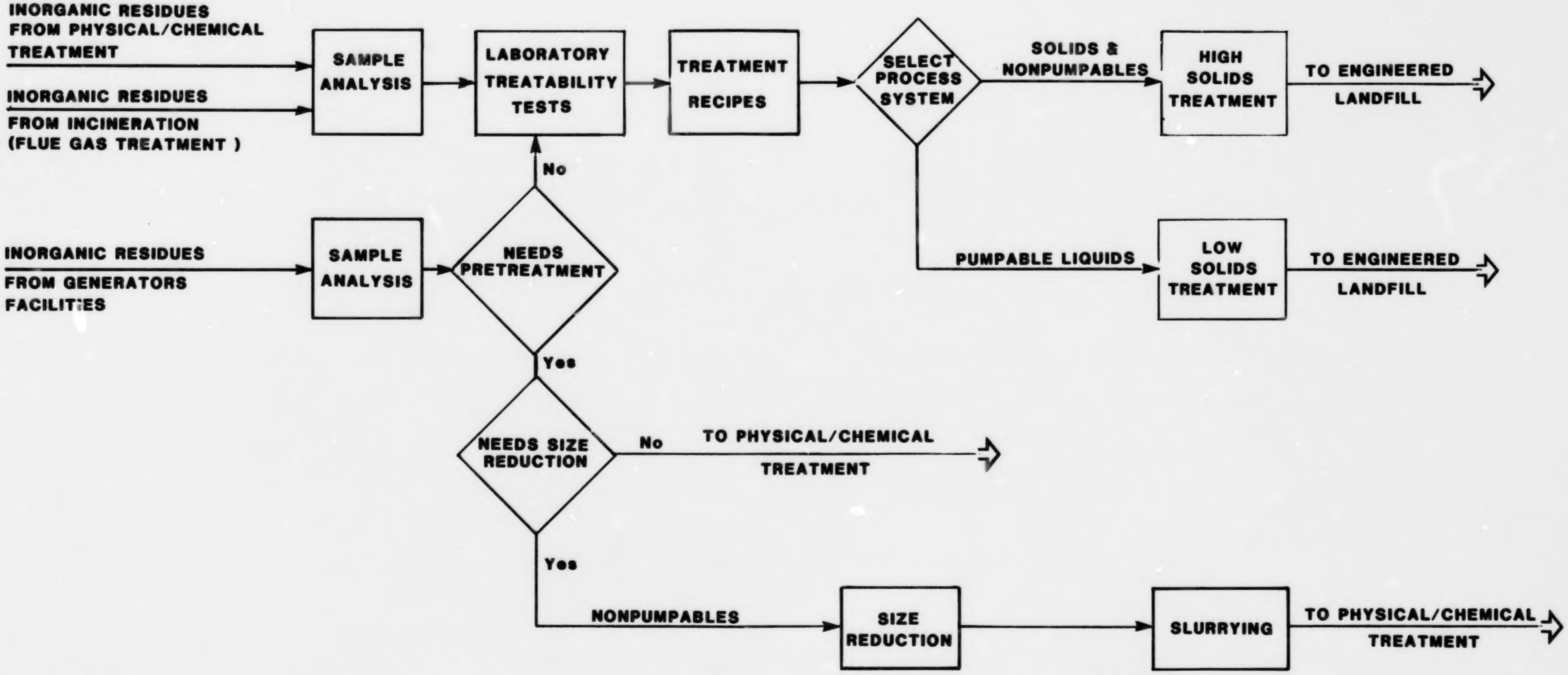

INORGANIC RESIDUES FROM PHYSICAL/CHEMICAL TREATMENT
INORGANIC RESIDUES FROM INCINERATION (FLUE GAS TREATMENT)
SAMPLE ANALYSIS
LABORATORY TREATABILITY TESTS
TREATMENT RECIPES
SELECT PROCESS SYSTEM
SOLIDS & NONPUMPABLES
HIGH SOLIDS TREATMENT
TO ENGINEERED LANDFILL
No
INORGANIC RESIDUES FROM GENERATORS FACILITIES
SAMPLE ANALYSIS
NEEDS PRETREATMENT
PUMPABLE LIQUIDS
LOW SOLIDS TREATMENT
TO ENGINEERED LANDFILL
Yes
NEEDS SIZE REDUCTION
No
TO PHYSICAL/CHEMICAL TREATMENT
Yes
NONPUMPABLES
SIZE REDUCTION
SLURRYING
TO PHYSICAL/CHEMICAL TREATMENT

FIGURE 3.23

SOLIDIFICATION PLANT
OPERATING PHILOSOPHY SCHEMATIC

3.5.6.2 Treatability Tests

The concept of performing bench scale treatability tests on advance samples of waste or residues prior to treatment is fundamental to the operation of the Facility. The characteristics of the waste and their treatment requirements will vary over a wide range and treatment at the Facility cannot be accomplished by a few standard methods for all the waste types anticipated.

Treatability tests on samples of each type of material will ensure that:

- the material will be subjected to the best combination of physical/chemical treatment steps followed by optimum solidification of the treatment residues,
- batches of residues of similar characteristics can be blended prior to solidification, and
- the solidified material quality will meet OWMC's objectives.

Significant operating experience will be gained during the initial years of facility operation and plant staff will become increasingly familiar with specific residue and waste types which may be of a repetitive nature. This will enable operators to call on their treatability data base for treatment formulations.

3.5.6.3 Operational Safety

The following operational safety features have been included in the proposed design and operation of the solidification plant to ensure that it is capable of operating with minimal risk to occupational health and the environment:

- All treatment processes within the solidification building are carried out in vessels which are totally enclosed. There will be no gaseous emissions during solidification.

- Solidification reagents are stored individually in separate enclosed silos. In all cases, fugitive dust is picked up by dust collectors before the air is discharged to atmosphere via roof vents.

- Liquid sodium silicate does not produce other fumes when storage tanks are being filled.

- The top inspection hatches on each mixer remain closed during the treatment sequence.

- Alarms and shutdown systems ensure that operating levels in storage tanks and silos are maintained and overflows are prevented. Similarly, excess flows in pumped and conveying systems are prevented.

- Interlocks in conveying systems ensure equipment items are operating in sequence and dumping of material to idle equipment is prevented.

- The various feed streams to the solidification plant are either non-hazardous or have been treated already in the physical/chemical treatment plant to render them non-hazardous. Reagents used for solidification are also non-hazardous and have a long history of industrial use. No corrosive materials will be handled. The processes do not require high temperatures or pressures.

- The area for storage and handling of dry solid and wet non-pumpable residues is segregated by a dust wall from the rest of the solidification building. Dust generated during unloading of these residues into storage and during transfer to crushing and handling equipment by the crane grab is collected in a bag filter before the air is vented to atmosphere.

- The control room is ventilated and air conditioned.

- The solidification building enclosing the treatment systems and reagent storage is ventilated in accordance with normal industry practice.

3.5.7 ABNORMAL OPERATION OR UPSET CONDITION

The following outlines the solidification plant operating philosophies, safety features and emergency procedures of the process design which are aimed at containing and minimizing the effects resulting from abnormal operation or upset conditions.

3.5.7.1 Spills and Leaks

- Minor spills or leaks from storage tanks, pump seals or mixing tanks will be contained for clean up by curbing around the base of the equipment.

- Storage bins for wet non-pumpable residues are located in concrete pits, thereby providing two levels of engineered containment for these wet residues.

- Spillage resulting from a ruptured tank will be collected in segregated sumps also designed to collect floor washwater. Any such spills will be contained. Alarms alert the operators that a spillage has occured.

3.5.7.2 Power Failure

- In the event of a power failure all motor driven equipment will stop. All filling valves on storage tanks and silos will fail closed, as will the control valves on the liquid feed lines and the soluble silicate feed line.

- Pumpable liquid feed, as well as soluble silicate, can remain in the pipelines until power is restored. Cement and additives can remain in the conveying ducts, as can materials in the conveying and handling systems, until power is restored.

- In the high solids treatment system, the batch in a mixer can remain even after addition of all solidification reagents as the set time is in the range of several hours, provided the power outage is temporary (less than one hour). If a prolonged power outage is anticipated, when mixers are in the mixing mode (all reagents have been added), the contents of such mixers will be dumped onto the concrete floor manually. On restoration of power, the batch can be returned to the mixer, if it has not solidified.

- In the low solids treatment system, the treated liquid/cement mixture in the mixing tank will not harden for days since soluble silicate is added downstream of the low solids discharge pump. Hence, the contents of the mixing tank can be processed on resumption of power supply. If prolonged power outage is anticipated, emergency power supply will activate the mixing tank agitators, discharge pump and pipeline mixer so that the contents of the mixing tank are processed and discharged. The equipment and pipeline downstream of the mixing tank will be flushed and cleaned.

3.5.7.3 Fire

- Appropriate fire protection systems are provided. It should be noted that none of the feed streams or reagents are combustible or explosive.

- The control room is protected by a "Halon" system.

3.5.7.4 Emergency Provisions

- Escape routes from all levels of the solidification plant are either via access stairways located at two strategic locations or via the physical/chemical treatment area.

- Emergency eyewash and shower stations are provided at strategic locations in the solidification building.

3.6 ENGINEERED LANDFILL

This section describes the engineered landfill including its associated engineered devices and the various facilities and services required for the operation of the landfill.

3.6.1 LANDFILL DESIGN

The purpose of the landfill is to provide secure containment for the residues remaining after the waste has undergone treatment.

The proposed landfill type is shallow entombed with the area method of development as shown on Figure 3.24. The landfill excavation extends 15 m below grade. Solidified material from the two solidification plants (pp 77, 148) and slag from the incineration plant (p. 76) is disposed of in the landfill by placement at depths between 5 and 15 metres below grade.

A profile through the landfill working area is shown on Figure 3.25.

3.6.2 ENGINEERED DEVICES

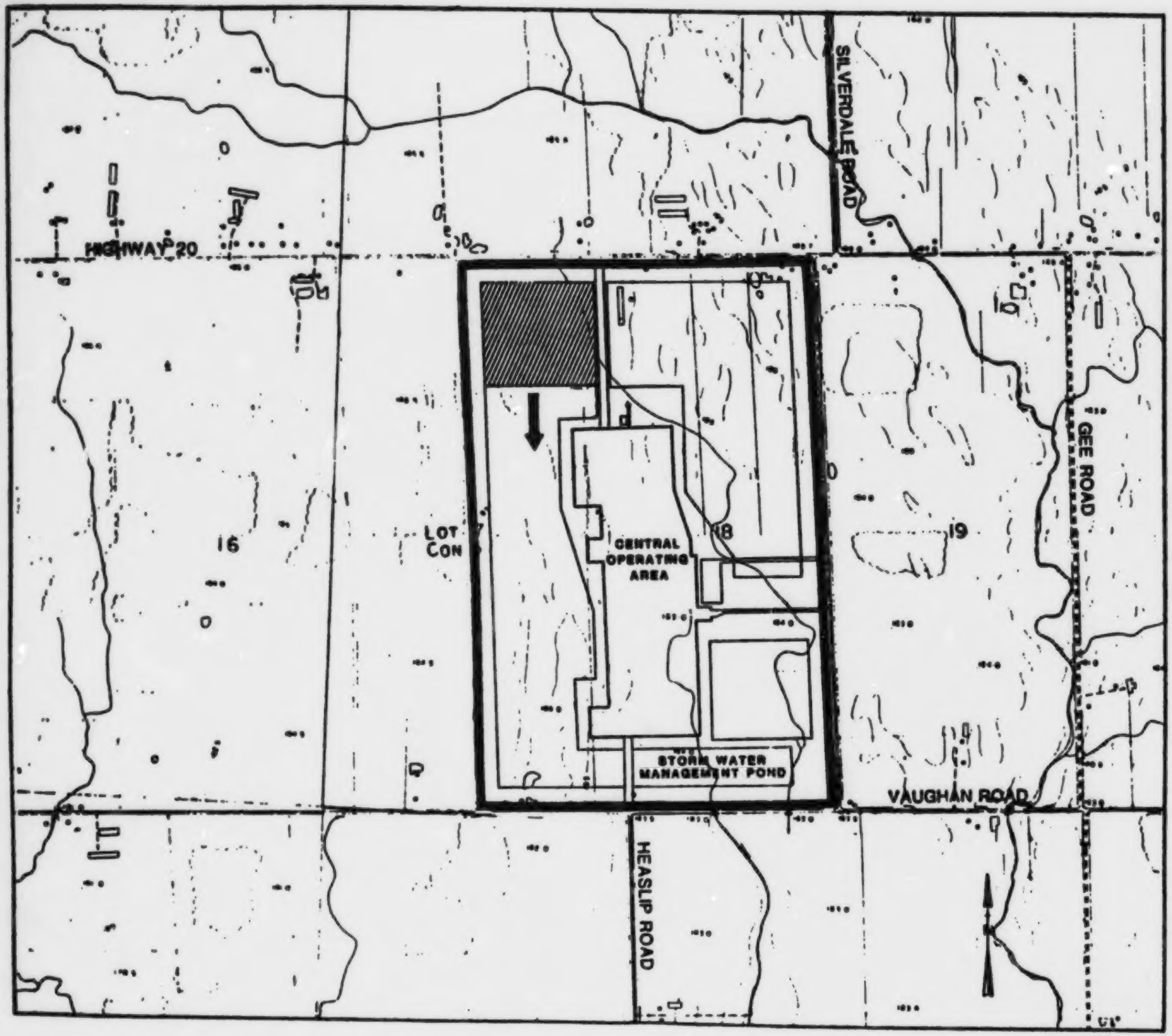
Engineered devices incorporated into the design of the landfill comprise:

- simple cover
- a native clay base, and
- an underdrain leachate collection system.

3.6.2.1 Simple Cover

The purpose of the cover is to minimize the rate of infiltration of precipitation into the solidified mass, and hence, minimize formation of leachate.

The cover proposed for the landfill consists of 5 m thick compacted clay from the landfill excavation plus restored top soil. Placement of the final cover will follow the advance of the working face in order to minimize the area open to precipitation. To achieve low hydraulic conductivity, the clay will be deposited under controlled conditions of


HIGHWAY 20
SILVERDALE ROAD
GEE ROAD
VAUGHAN ROAD
HEASLIP ROAD
16
LOT
CON
18
19
CENTRAL OPERATING AREA
STORM WATER MANAGEMENT POND

OWMC Ontario Waste Management Corporation

Consultant

DILLON

Legend: **LF-9Central**

↓ Direction of Landfill Advancement

▨ Initial Landfill Development

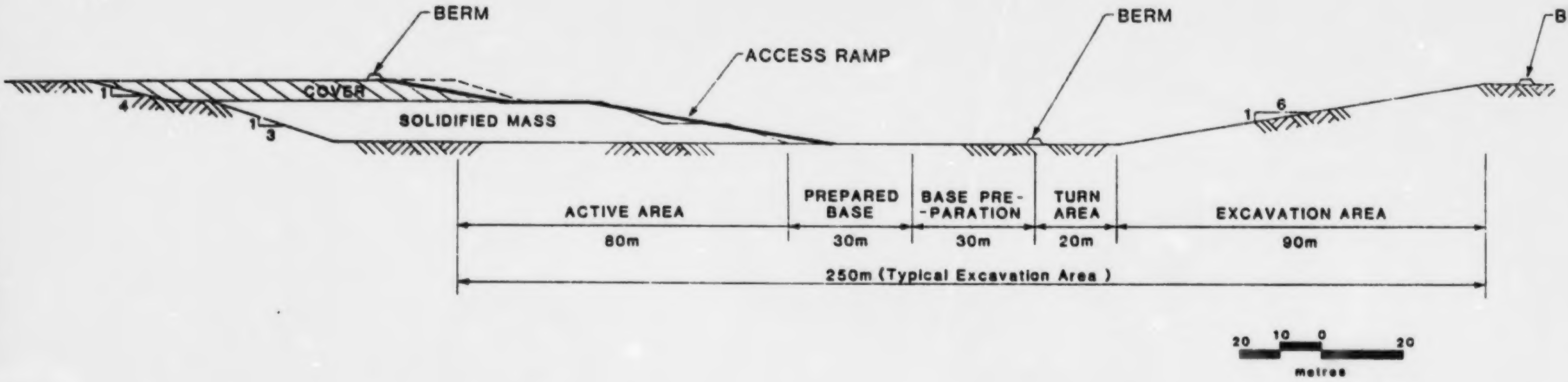
▬ Acquisition Boundary

0 1000 feet
0 300 metres
1:10 000

INITIAL LANDFILL DEVELOPMENT AREA

FIGURE 3.24

JULY 1986
(Based on Dec.1985 Original)


BERM
ACCESS RAMP
BERM
BERM
COVER
SOLIDIFIED MASS
1
4
1
3
1
6
ACTIVE AREA
80m
PREPARED BASE
30m
BASE PRE-
-PARATION
30m
TURN AREA
20m
EXCAVATION AREA
90m
250m (Typical Excavation Area)
20
10
0
20
metres

DILLON

PROFILE THROUGH LANDFILL WORKING AREA
FIGURE 3.25

moisture content, lift thickness and compaction. Due to the problems of winter freezing impeding compaction, this operation is limited to the summer months (typically May to October).

Topsoil will be applied to the completed cover and revegetation undertaken as soon as climatic conditions permit.

Final topography of the landfill cover is being evaluated and will be documented in the final Facility Description report.

3.6.2.2 Native Clay Base

This consists of the native clay as exposed by excavation.

3.6.2.3 Underdrain Leachate Collection System

The underdrains provide a means to collect leachate generated in the landfill so that the leachate may be tested and if necessary, treated in the physical/chemical treatment plant.

As discussed in the Engineered Landfill PAR (Ref: Monenco[12]), the mode of operation for the underdrains (leachate collection system) will be passive. The provision for the active mode of operation allows a high level of control should the leachate quality be of concern.

The underdrain system generally consists of a highly permeable granular layer or synthetic drainage net at the bottom and side slopes (where applicable). Drainage is accomplished by pumping from a piping system or from a sump that is gravity fed from the underdrain system.

The above options are being evaluated and will be documented in the final Facility Description report.

3.6.3 FACILITIES AND SERVICES

Facilities and services comprise the components required for the operation of the landfill.

3.6.3.1 Solidified Material Handling

Materials for landfilling are:

- slag from the rotary kiln incinerator (p. 76), transported by truck, in drop box portable containers and tipped at the landfill working face.

- solid residues from the waste heat recovery boiler (ie. ash), spray dryer and electrostatic precipitator (ie. salt/flyash) which has been further processed in the dedicated solidification plant at the incineration plant (p. 77), transported by truck, in dumpsters and tipped at the landfill working face.

- solidified material from the high solids treatment system at the solidification plant (p. 148), transported by tipper truck and tipped at the landfill working face, and

- solidified material from the low solids treatment system at the solidification plant (p. 149), pumped to the landfill working face via a pipeline. The pipeline is of the moveable type so as to be able to discharge the low solids solidified material at any location in the landfill.

3.6.3.2 Landfill Access Roads

Access roads are of two types, permanent and temporary. The permanent roads follow the perimeter of each of the blocks of landfill area and connect with the central operating area. They are designed for all weather travel but not paved. The temporary access roads depart from the permanent access roads to provide access to the current working area. While they are also designed for all weather travel, they will be relocated as necessary to service the working area.

3.6.3.3 Surface Drainage

The purpose of the surface drainage system for the landfill is to segregate potentially contaminated surface water from uncontaminated surface water and to limit post-development 100 year storm water flows off-site, to pre-development levels.

Perimeter ditching is provided around the entire site boundary to divert upstream surface drainage around OWMC's Facility to the existing downstream drainage channels. In addition, provision is made to construct a berm on the inside of the perimeter ditch. This berm acts as a drainage divide to keep on-site surface drainage separate from off-site surface drainage and in addition provides a visual and noise barrier.

Uncontaminated Surface Water

Surface water which has no opportunity to come into contact with the solidified material is considered uncontaminated. This includes drainage from complete or as yet undisturbed areas of the landfill.

The final cover of the landfill restores the ground surface to original grade. The surface will be shaped to provide a network of shallow swales, spaced to take into account the expected active depth of the shallow ground water flow system. The swales drain directly to the perimeter ditches inside the berm and into the storm water management pond. Smaller drainage areas in the buffer zone between the berm and the perimeter access road drain to minor ditches and discharge through culverts to the perimeter ditch inside the berm.

The excavation perimeter is entirely bermed to prevent surface run off from entering the excavation. The excavation is further subdivided by a temporary berm separating the active excavation area from the area of filling and underdrain construction. Precipitation collecting in the area of filling where there is a likelihood of contact with the solidified material is treated as contaminated water or leachate. Precipitation collected on the other side of the berm where excavation is proceeding is considered potentially contaminated and pumped to a holding pond in the active landfill area.

All uncontaminated drainage discharges to the storm water management pond prior to off-site discharge. The pond serves both functions of storm water detention and sediment control.

Potentially Contaminated Surface Water

Any surface water which may come into contact with solidified material, such as that which may have spilled from the pipeline, or been tracked by excavation equipment, is considered to be potentially contaminated. The area where equipment emerges from the active fill area, the access roads over which they travel to the load-out area and the equipment storage compound, plus the area which drains the route taken by the pipeline, may generate contaminated surface water. The drainage from these areas is isolated and directed to potentially contaminated water storage ponds. Water in the ponds is tested before releasing to the surface drainage system. If found to be contaminated, the contents of the pond are discharged to the physical/ chemical treatment plant for treatment.

3.6.4 NORMAL OPERATION

The following outlines the engineered landfill operating philosophies and features of the design that ensure the landfill performs and operates in a safe and environmentally sound manner.

3.6.4.1 General

- The engineered landfill will operate 8 hours per day, five days per week with overnight storage of solidified material. The operation of heavy equipment will be limited to daylight hours.

- For the typical operating case, approximately 25% of the volume of solidified material from physical/chemical treatment will be from low solids material and will be pumped to the landfill via pipeline. The remaining 75% plus the slag and solidified material from the incineration plant will be high solids material which will be trucked to landfill. The trucked material will be spread and compacted in the landfill, the piped solidified material will be delivered to the landfill working area by moveable pipeline. It may be necessary to contain the solidified material delivered by pipeline with berms, until it sets.

- No raw untreated waste goes directly to the landfill. Only residues from the incineration and physical/chemical treatment plants will be placed in the landfill. With the exception of rotary kiln slag, for which solidification does not enhance physical or chemical stability, all waste residues first pass through the solidification plant processes before going to landfill.

- Leachate from the landfill, contaminated surface drainage and potentially contaminated surface drainage will be tested and if contaminated, will be discharged to the physical/chemical treatment plant for processing in the miscellaneous waste treatment system.

3.7 GENERAL FACILITIES

The parts of the Facility, referred to as General Facilities provide the basic infrastructure that integrates the treatment and disposal technologies into an overall Facility to treat Ontario's special waste in an environmentally safe manner.

This section describes the facility layout as well as the major components and also the various services provided on site as follows:

- tank truck unloading,
- incinerator tank farm and physical/chemical tank storage area,
- drum storage and handling,
- utilities, services and buildings,
- data management system and process control,
- electrical systems and communications,
- fire protection,

- vent emission control and nitrogen blanketting systems,
- truck wash,
- laboratories, and
- safety and security.

3.7.1 FACILITY LAYOUT

The facility layout is shown on Figure 3.2 and its relationship to the site is shown on Figure 3.3; a perspective of the Facility is depicted on Figure 3.1.

The conceptual layout provides a Facility with:

- the organic processing components located at the south end,
- the inorganic processing components located at the north end, and
- the waste delivery, handling and storage located in the centre.

In addition, this arrangement provides the simplest most direct traffic pattern within the Facility.

3.7.2 TANK TRUCK UNLOADING

The tank truck unloading facilities are described in Section 3.2 under waste delivery. Section 3.2 addresses all aspects of waste delivery to the Facility including the various unloading facilities provided.

3.7.3 INCINERATOR TANK FARM AND PHYSICAL/CHEMICAL STORAGE TANK AREA

The incinerator tank farm and physical/chemical storage tank facilities comprise separate storage for the wastes delivered to OWMC's Treatment Facility in accordance with the waste handling and storage described in Section 3.2.2 (p. 33).

3.7.3.1 Incinerator Tank Farm

The incinerator tank farm is located outdoors, adjacent to the organic tank truck unloading area as shown on Figure 3.2.

Figure 3.26 provides a diagrammatic arrangement of the incinerator tank farm.

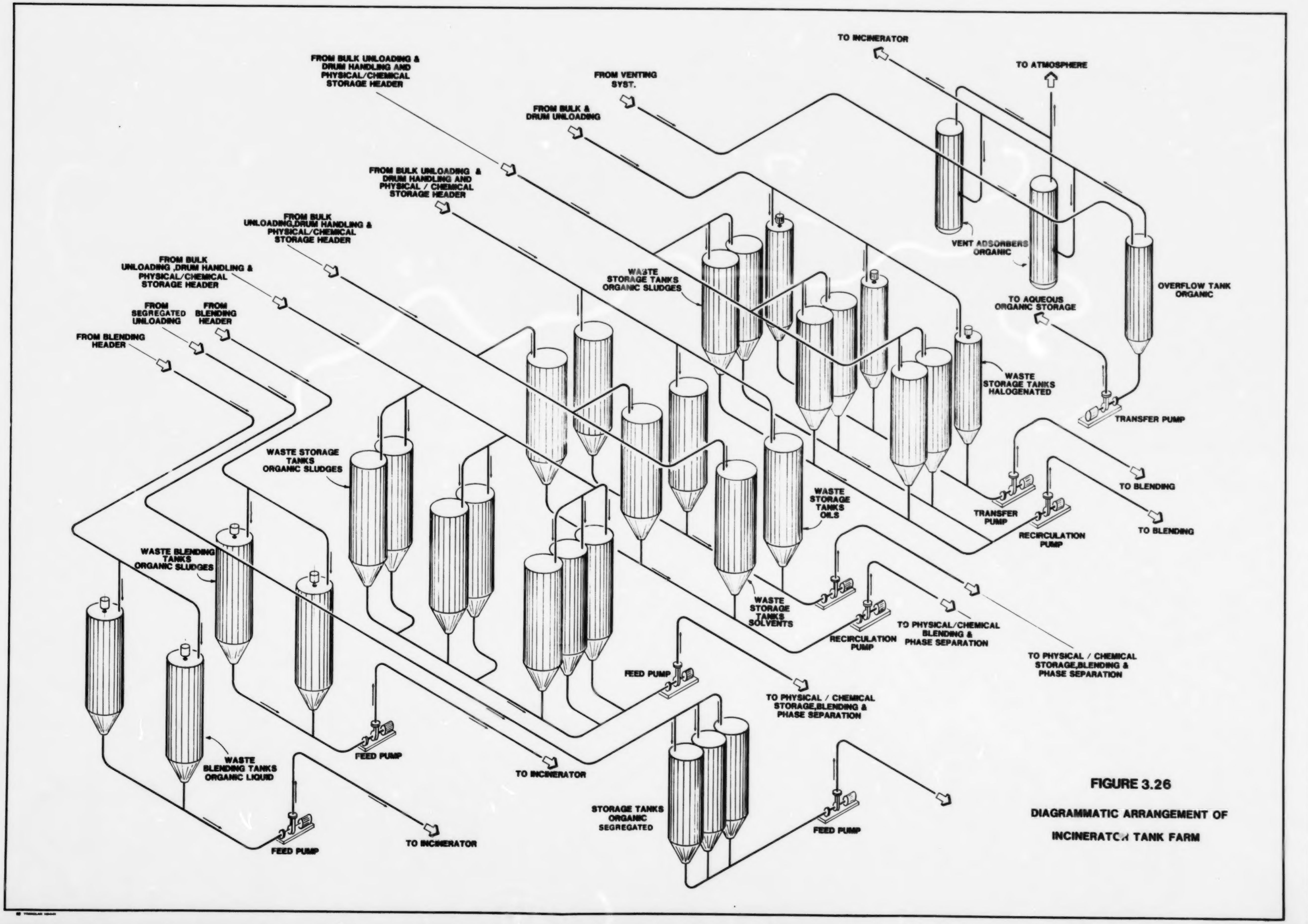

TO INCINERATOR
TO ATMOSPHERE
FROM VENTING SYST.
FROM BULK & DRUM UNLOADING
FROM BULK UNLOADING & DRUM HANDLING AND PHYSICAL/CHEMICAL STORAGE HEADER
FROM BULK UNLOADING & DRUM HANDLING AND PHYSICAL / CHEMICAL STORAGE HEADER
FROM BULK UNLOADING,DRUM HANDLING & PHYSICAL/CHEMICAL STORAGE HEADER
FROM BULK UNLOADING ,DRUM HANDLING & PHYSICAL/CHEMICAL STORAGE HEADER
FROM SEGREGATED UNLOADING
FROM BLENDING HEADER
FROM BLENDING HEADER
VENT ADSORBERS ORGANIC
OVERFLOW TANK ORGANIC
TO AQUEOUS ORGANIC STORAGE
WASTE STORAGE TANKS ORGANIC SLUDGES
WASTE STORAGE TANKS HALOGENATED
TRANSFER PUMP
TO BLENDING
TRANSFER PUMP
RECIRCULATION PUMP
TO BLENDING
WASTE STORAGE TANKS OILS
WASTE STORAGE TANKS ORGANIC SLUDGES
WASTE STORAGE TANKS SOLVENTS
RECIRCULATION PUMP
TO PHYSICAL/CHEMICAL BLENDING & PHASE SEPARATION
TO PHYSICAL / CHEMICAL STORAGE,BLENDING & PHASE SEPARATION
WASTE BLENDING TANKS ORGANIC SLUDGES
FEED PUMP
TO PHYSICAL / CHEMICAL STORAGE,BLENDING & PHASE SEPARATION
FEED PUMP
TO INCINERATOR
WASTE BLENDING TANKS ORGANIC LIQUID
STORAGE TANKS ORGANIC SEGREGATED
FEED PUMP
FEED PUMP
TO INCINERATOR

FIGURE 3.26

DIAGRAMMATIC ARRANGEMENT OF INCINERATOR TANK FARM

Figure 3.27 illustrates the conceptual layout of the incinerator tank farm.

The waste storage tanks in the incinerator tank farm are segregated, as shown on Figure 3.27, into the following groups:

- aqueous organics,
- waste solvents,
- waste oils,
- organic sludges,
- halogenated wastes,
- segregated organics, and
- blending (liquids and sludges).

Aqueous Organics

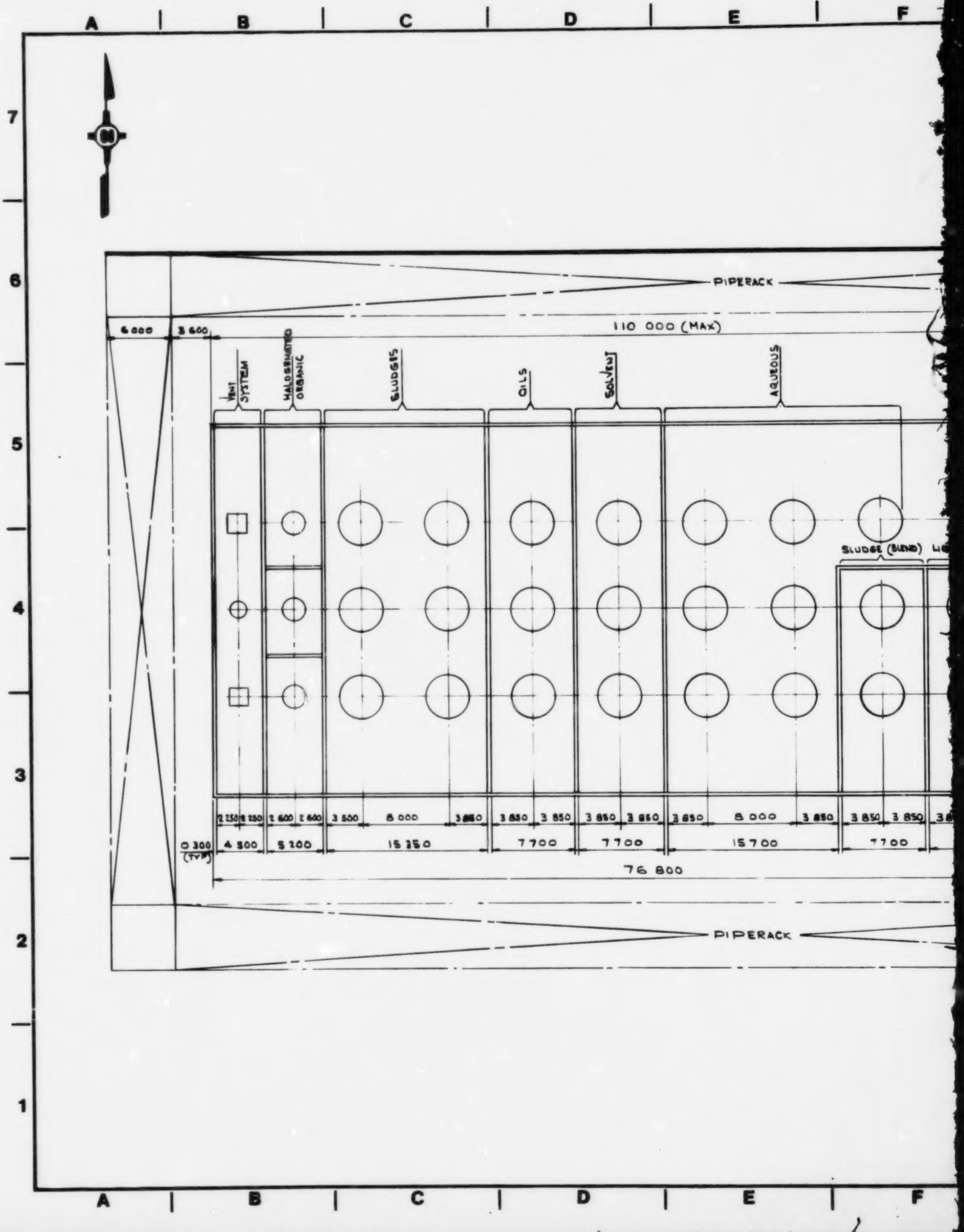
Aqueous organic storage consists of seven tanks with a storage capacity of 120 m^3 each. Feed of aqueous organic waste to the storage tanks is from the following sources:

- organic tank truck unloading area (p. 34),
- organic drum storage and handling building (p. 185),
- recovered organics from the aqueous organic treatment system in the physical/chemical treatment plant (pp 115, 116), and
- recovered organics from phase separation at the aqueous organic storage tanks in the physical/chemical storage tank area (p. 182).

Remote operated valves direct the waste into the designated storage tank.

Each tank is of carbon steel construction, of vertical, cylindrical configuration, hopper bottomed (complete with steam plate coil heaters), and insulated. Sample ports are provided on all tanks.

A storage recirculation pump is provided for each tank to serve the following functions:


A
B
C
D
E
F
7
6
5
4
3
2
1
N
PIPERACK
6 000
3 600
110 000 (MAX)
VENT SYSTEM
HALOGENATED ORGANIC
SLUDGES
OILS
SOLVENT
AQUEOUS
SLUDGE (BLEND)
2 250
2 250
2 600
2 600
3 500
8 000
3 850
3 850
3 850
3 850
3 850
3 850
8 000
3 850
3 850
3 850
0 300 (TYP)
4 500
5 200
15 350
7700
7700
15700
7700
76 800
PIPERACK

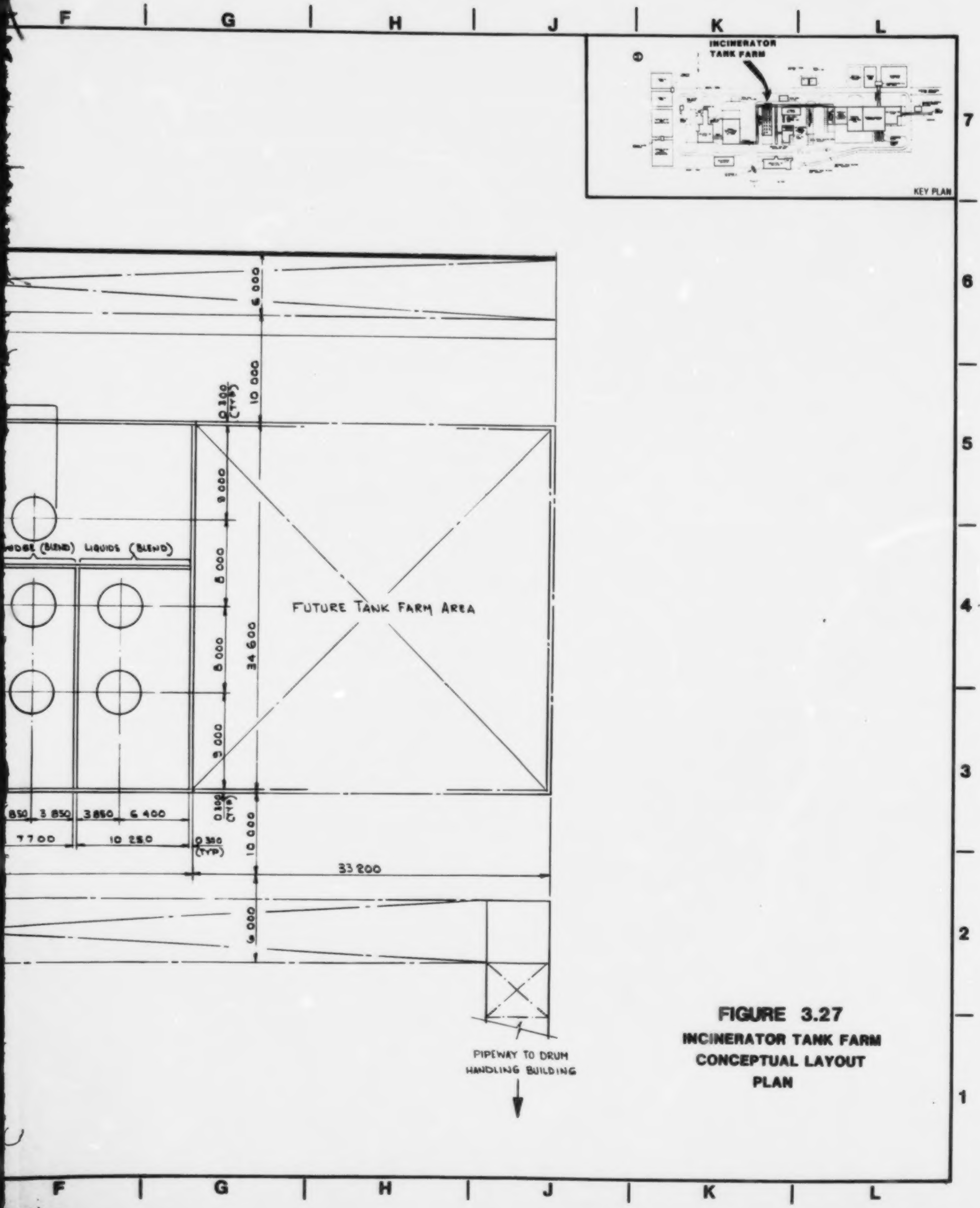

F
G
H
J
K
L
INCINERATOR TANK FARM
KEY PLAN
7
6
5
4
3
2
1
6 000
10 000
0 300 (TYP)
9 000
8 000
8 000
9 000
34 600
FUTURE TANK FARM AREA
DGE (BLEND)
LIQUIDS (BLEND)
850
3 850
3 850
6 400
7 700
10 250
0 300 (TYP)
10 000
0 350 (TYP)
33 200
6 000
PIPEWAY TO DRUM HANDLING BUILDING

FIGURE 3.27
INCINERATOR TANK FARM
CONCEPTUAL LAYOUT
PLAN

- recirculation/mixing of tank contents,
- pump-out of accumulated sludge from tank bottom to the organic sludges waste storage tanks (p. 173),
- pump-out to the organic liquid blending tanks (p. 175), and
- pump-out of separated aqueous phase to the aqueous organic storage tanks in the physical/chemical storage tank area (p. 182).

Remote operated valves are provided for directing waste to the designated receiving tank or recirculating back to storage and the pumps are remotely started and stopped.

Aqueous organic waste can be drawn from any one of the seven aqueous organic storage tanks using one of the two 100% duty aqueous organic incinerator feed pumps. Aqueous organic wastes are pumped to the aqueous waste lance located in the front wall of the rotary kiln (p. 59) and to the two aqueous waste lances located in the secondary combustion chamber (p. 59). A recirculation line from the aqueous waste lances at the incinerator is provided to prevent settling of solids in the feed line, with recirculation directed back to the operational aqueous organic storage tank.

Waste Solvents

Waste solvent storage consists of three tanks with a storage capacity of 120 m^3 each. Feed of waste solvent to the storage tanks, valve operation and recirculation/pump-out is identical to the aqueous organic storage except that the recirculation pump is also used to transfer waste solvents to the organic liquids blending tanks for blending with other organic liquids prior to incineration.

Waste Oils

Waste oil storage and operation is identical to that of waste solvents.

Organic Sludges

Organic sludge storage consists of six tanks with a storage capacity of 120 m^3 each. Feed of organic sludge to the storage tanks is from the following sources:

- organic tank truck unloading (p. 34),
- organic drum storage and handling building (p. 185), and
- aqueous organic, waste solvent or waste oil storage tanks.

Remote operated valves direct the waste into the designated storage tank.

Each tank is of carbon steel construction, of vertical, cylindrical configuration, hopper bottomed (complete with steam plate coil heaters), and insulated. Sample ports are provided on the tanks.

A storage recirculation pump is provided for each tank to serve the following functions:

- recirculation/mixing of tank contents, and
- pump-out to the organic sludge blending tanks (p. 176).

Halogenated Wastes

Certain halogenated wastes will be stored in separate storage tanks due to the waste characteristics.

Halogenated waste storage consists of three tanks with a storage capacity of 10 m^3 each. Feed of halogenated wastes to the storage tanks is from the following sources:

- organic tank truck unloading (p. 34), and
- drum storage and handling building (p. 185).

Remote operated valves direct the waste into the designated storage tank.

Each tank is of carbon steel construction, of vertical, cylindrical configuration, hopper bottomed (complete with steam plate coil heaters), and insulated. Sample ports are provided on all tanks.

Halogenated waste is drawn from any one of the three halogenated waste storage tanks using one of two 100% duty halogenated waste transfer pumps. Halogenated waste is pumped to the organic liquid blending tanks for blending with other organic liquids prior to incineration.

In addition, the halogenated waste transfer pumps can be used for recirculation/mixing of the halogenated waste.

Segregated Organics

Segregated organic wastes such as polychlorinated biphenyls (PCBs), that require segregated unloading and storage are handled at the segregated organic storage tank area located adjacent to the incinerator tank farm (see Figure 3.2).

After passing through routine reception procedures which include weighing and checking of manifest papers (p. 30), road tanker contents that require special unloading and storage are directed to the segregated organic storage facility.

This facility consists of two 100% duty waste unloading/transfer pumps, three waste storage tanks with a storage capacity of 40 m^3 each, and two 100% duty incinerator feed pumps.

Each storage tank is of carbon steel construction, of vertical, cylindrical configuration, hopper bottomed (complete with steam plate coil heaters), insulated and equipped with an agitator. Sample ports are provided on all tanks.

These organic wastes are unloaded into any one of the three storage tanks with remote operated valves directing the waste into the designated storage tank. The waste unloading and transfer pumps can also be utilized to transfer the waste between storage tanks.

Waste will be drawn from any one of the three storage tanks using one of the incinerator feed pumps and pumped to the front wall burner of the rotary kiln. A recirculating line from the incinerator feed is provided to prevent settling in the incinerator feed line, with recirculation directed back to the tank from which the pump is taking suction. Remote operated valves are provided for the selection of storage tank, for pump suction and for recirculation. The pump is started remotely from the incinerator control centre.

Blending (Liquids and Sludges)

Except for segregated organic and aqueous organic wastes, all organic wastes are transferred to organic liquid or sludge waste blending tanks before being fed to the incinerator. Based on the waste characteristics, wastes are added to the blending tanks in a manner that optimizes heating value, sulphur content, chlorine content, moisture content and inerts content.

Blending of organic wastes is achieved in the waste blending tanks as follows:

- Organic Liquids comprising:
    - aqueous organics,
    - waste solvents,
    - waste oils, and
    - halogenated wastes.
- Organic Sludges

Organic Liquids. Organic liquid blending consists of two tanks with a storage capacity of 60 m^3 each. In normal operation, one blending tank is in service feeding blended liquid waste to the incinerator while the second tank is being used to prepare the next batch of blended liquid waste for incineration.

Each blending tank is of carbon steel construction, of vertical, cylindrical configuration, hopper bottomed (complete with steam plate coil heater), insulated and equipped with an agitator. Sample ports are provided on the tanks for sampling the blended waste to confirm its characteristics prior to incineration.

Blending is achieved by agitation and recirculation using the single waste blending pump.

Blended waste is fed to the organic liquid lance at the incinerator using one of the two 100% duty incinerator feed pumps. A recirculation line from the incinerator feed is provided to prevent settling in the incinerator feed line, with recirculation directed back to the operating tank. Remote operated valves provide for the selection of storage tank, for pump suction and for recirculation, with the selected pump started remotely.

Organic Sludges. Organic sludge blending also consists of two tanks and is identical to organic liquid blending with the exception of the blended waste feed to the incinerator. Blended organic sludge wastes are fed to the sludge head tank in the incinerator building. The sludge head tank acts as a buffer storage (p. 60).

Flexibility

Flexibility in the piping arrangement enables organic liquid and sludges to be:

- transferred between storage tanks,
- transferred between blending tanks,
- used for a different duty than that previously designated,
- transferred from storage tanks to incinerator receiving tanks at the organic tank truck unloading, and
- transferred from blending tanks to storage tanks.

Inert Gas Blanketting

The organic storage and blending tanks are blanketted with nitrogen to protect against explosion and fire. A common nitrogen supply system services the incinerator tank farm and the incinerator waste receiving tanks at the organic tank truck unloading area while a separate nitrogen supply system services the segregated storage tanks. This system is described in Section 3.7.9.1 (p. 238).

3.7.3.2 Physical/Chemical Storage Tank Area

The physical/chemical storage tank area is located in a building adjacent to the physical/chemical treatment plant as shown on Figure 3.2.

Figure 3.28 provides a diagrammatic arrangement of physical/chemical storage.

Figure 3.29 illustrates the conceptual layout of the physical/chemical storage tank area.

The waste storage tanks in the physical/chemical storage tank area are segregated, as shown on Figure 3.29, into the following:

- neutral/alkaline,
- acidic, and
- aqueous organic.

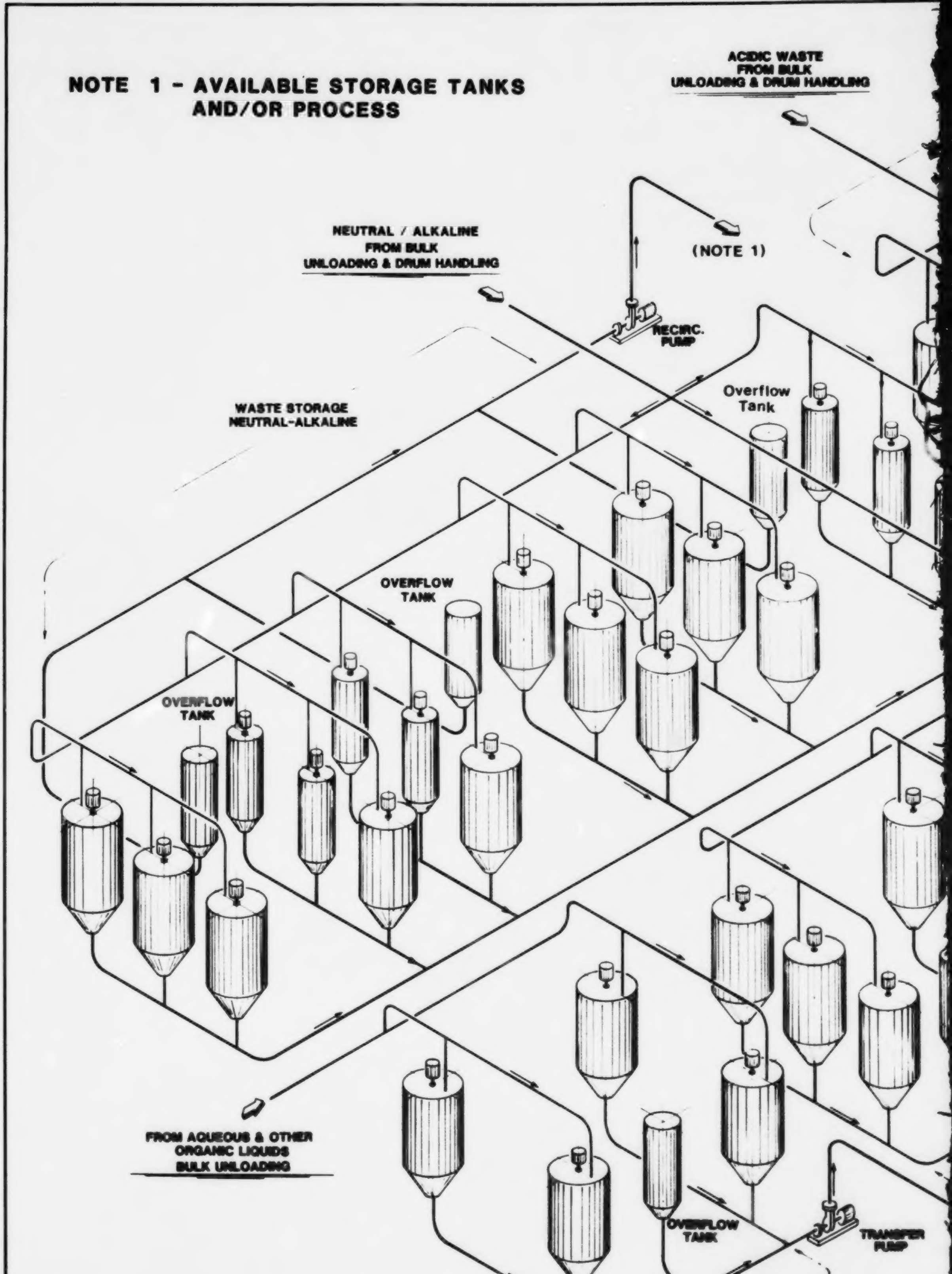
Miscellaneous wastes which are by nature very dilute, are stored separately in ponds located on the plant site and landfill area.

The physical/chemical storage tank area is heated to prevent the inorganic and aqueous organic wastes from freezing during storage.

Neutral/Alkaline and Acidic

Storage for neutral/alkaline and acidic wastes is grouped into modules of six storage tanks holding compatible wastes as follows:

- neutral/acidic - 5 modules, and
- acidic - 4 modules.


NOTE 1 - AVAILABLE STORAGE TANKS AND/OR PROCESS
ACIDIC WASTE FROM BULK UNLOADING & DRUM HANDLING
(NOTE 1)
NEUTRAL / ALKALINE FROM BULK UNLOADING & DRUM HANDLING
RECIRC. PUMP
Overflow Tank
WASTE STORAGE NEUTRAL-ALKALINE
OVERFLOW TANK
OVERFLOW TANK
FROM AQUEOUS & OTHER ORGANIC LIQUIDS BULK UNLOADING
OVERFLOW TANK
TRANSFER PUMP
WASTE STORAGE AQUEOUS ORGANICS

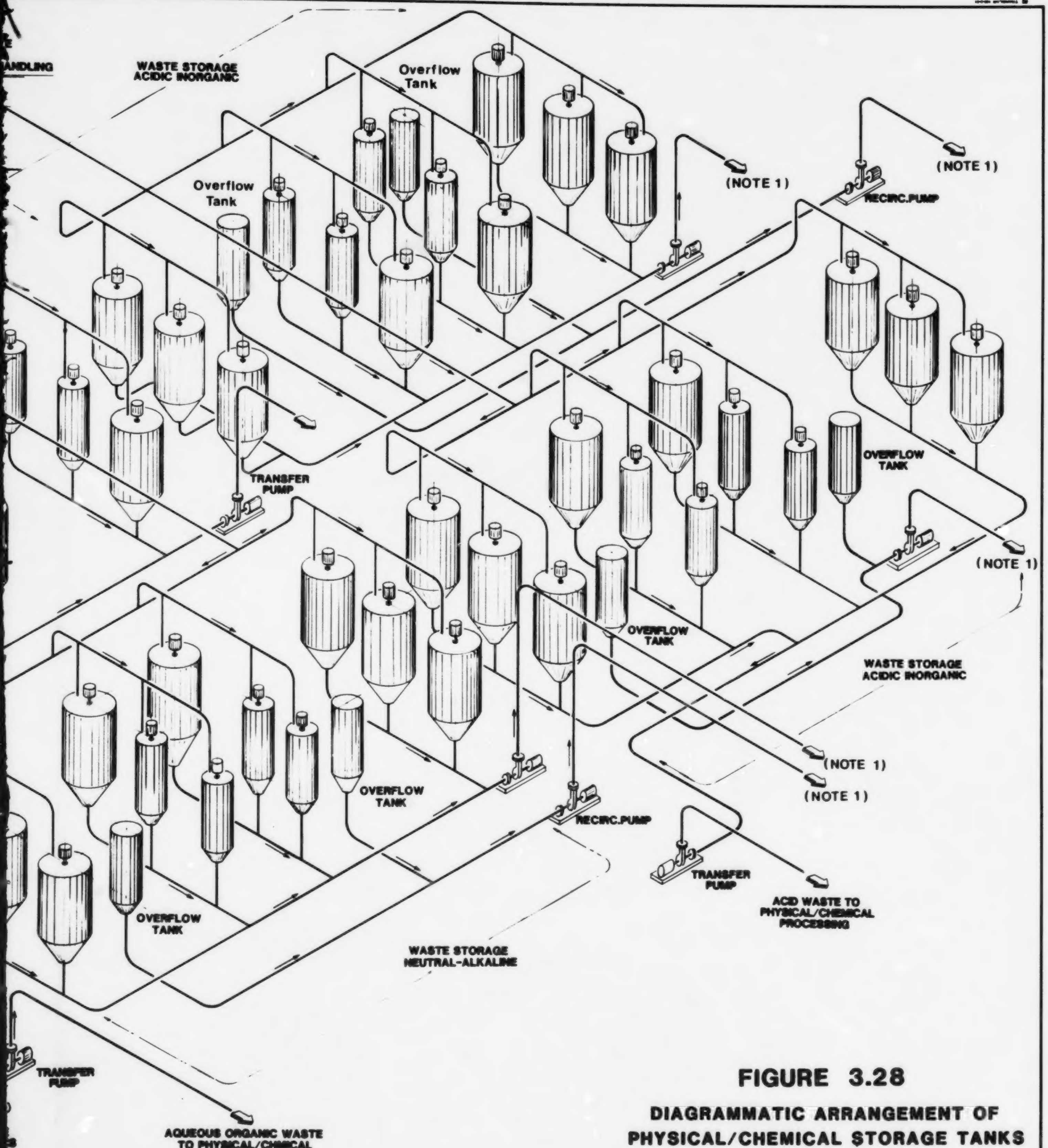
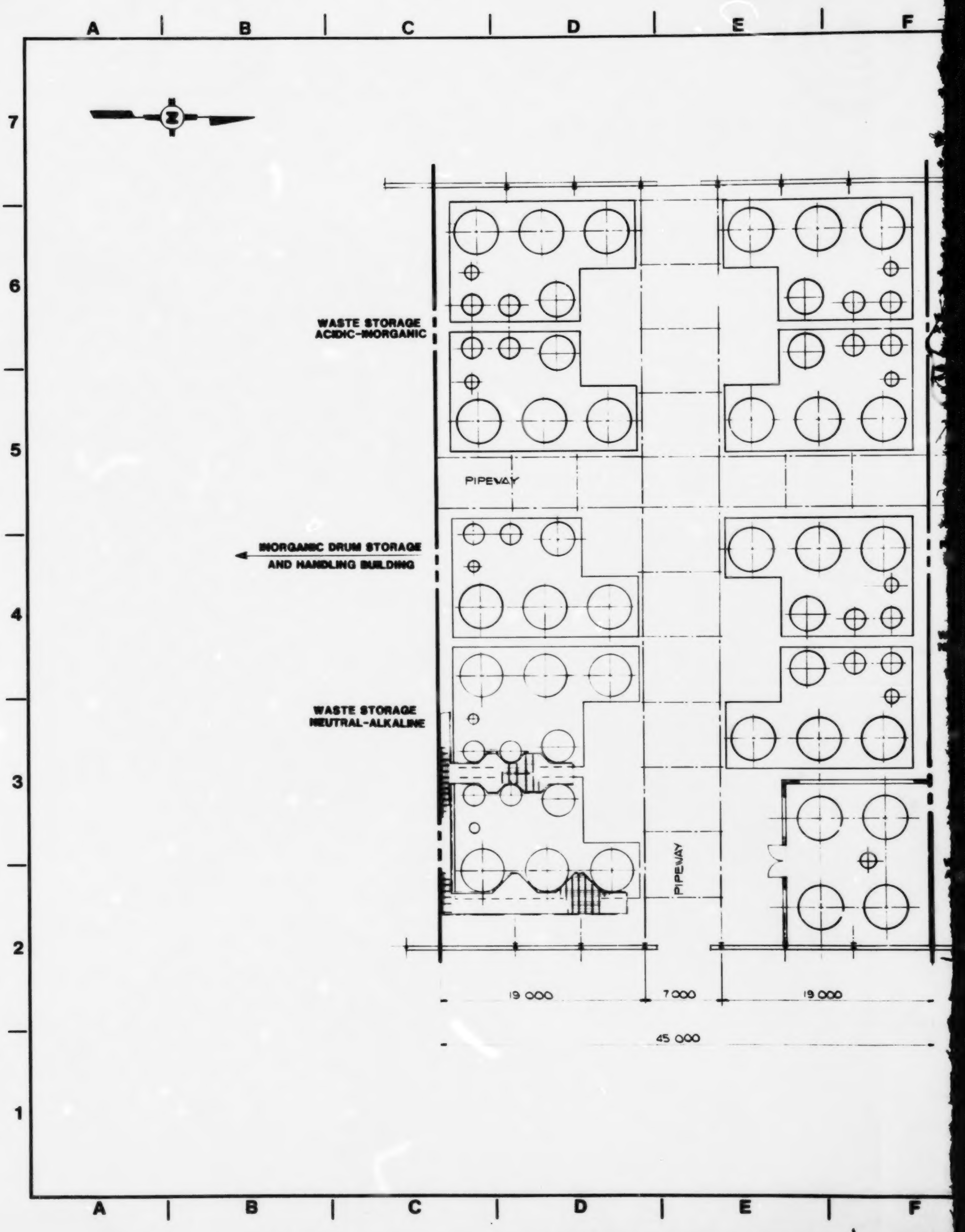

ANDLING
WASTE STORAGE
ACIDIC INORGANIC
Overflow
Tank
Overflow
Tank
(NOTE 1)
(NOTE 1)
RECIRC.PUMP
TRANSFER
PUMP
OVERFLOW
TANK
(NOTE 1)
OVERFLOW
TANK
WASTE STORAGE
ACIDIC INORGANIC
(NOTE 1)
(NOTE 1)
OVERFLOW
TANK
RECIRC.PUMP
TRANSFER
PUMP
ACID WASTE TO
PHYSICAL/CHEMICAL
PROCESSING
OVERFLOW
TANK
WASTE STORAGE
NEUTRAL-ALKALINE
TRANSFER
PUMP
AQUEOUS ORGANIC WASTE
TO PHYSICAL/CHEMICAL
PROCESSING

FIGURE 3.28

DIAGRAMMATIC ARRANGEMENT OF
PHYSICAL/CHEMICAL STORAGE TANKS


A
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2
1
WASTE STORAGE
ACIDIC-INORGANIC
PIPEWAY
INORGANIC DRUM STORAGE
AND HANDLING BUILDING
WASTE STORAGE
NEUTRAL-ALKALINE
PIPEWAY
19 000
7 000
19 000
45 000

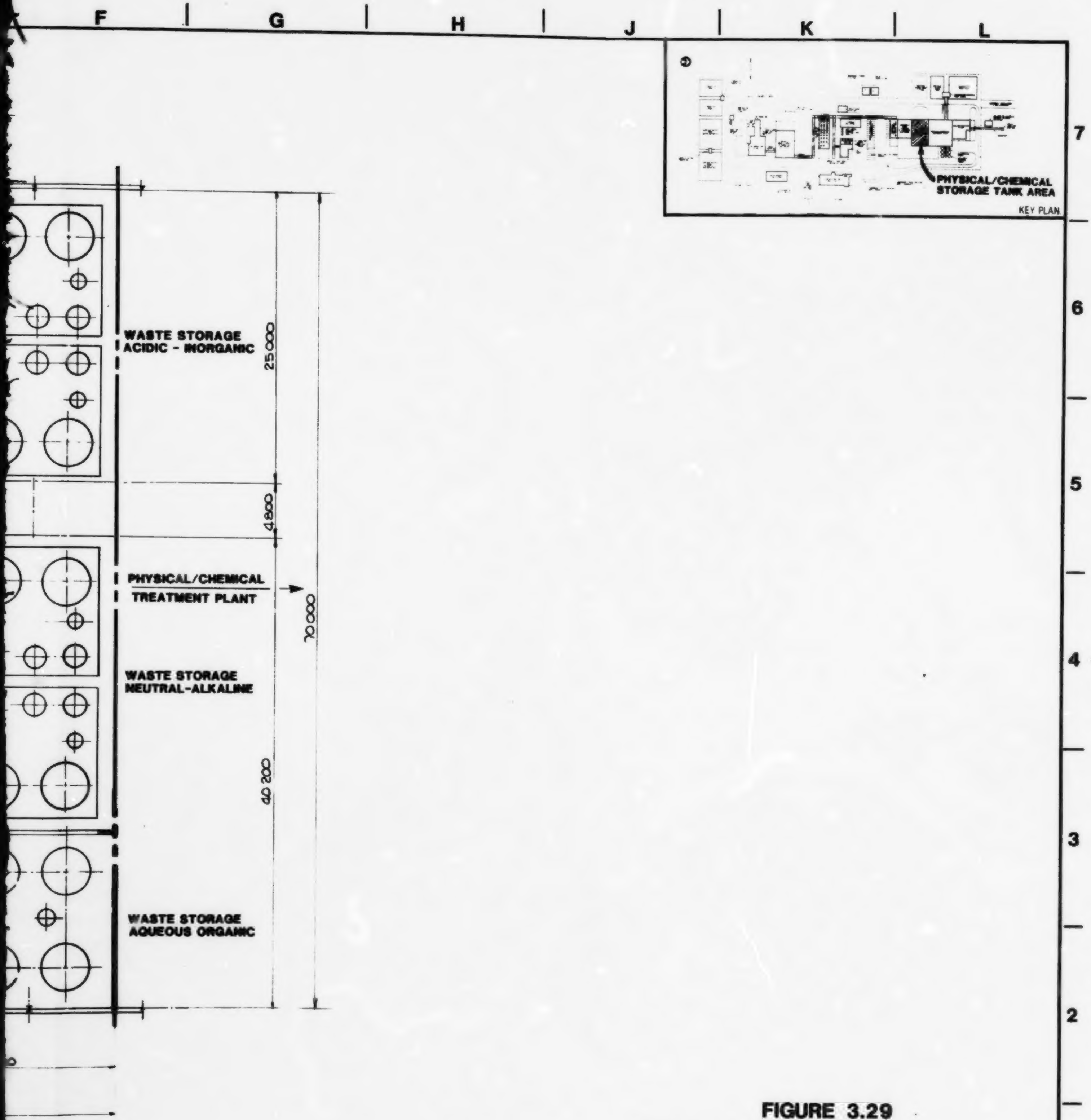

F
G
H
J
K
L
7
6
5
4
3
2
1
PHYSICAL/CHEMICAL
STORAGE TANK AREA
KEY PLAN
WASTE STORAGE
ACIDIC - INORGANIC
25 000
4 800
PHYSICAL/CHEMICAL
TREATMENT PLANT
70 000
WASTE STORAGE
NEUTRAL-ALKALINE
40 200
WASTE STORAGE
AQUEOUS ORGANIC

FIGURE 3.29

PHYSICAL/CHEMICAL STORAGE TANK AREA
CONCEPTUAL EQUIPMENT LAYOUT
PLAN

Each module will consist of:

- 3 - 40 m^3 capacity waste storage tanks,
- 1 - 20 m^3 capacity waste storage tank,
- 2 - 10 m^3 capacity waste storage tanks, and
- 1 - 4 m^3 capacity overflow tank.

Feed of inorganic waste to the storage tanks is from the following sources:

- inorganic tank truck unloading area (p. 39), and
- truck wash station (p. 242)/wash water header.

In addition, the neutral/alkaline waste storage tanks can receive slurry from the solidification plant (pp. 147, 148).

Remote operated valves are provided for directing waste to the designated storage tank and the inlet valves close at high level to prevent overfilling of the storage tanks. In addition, the overflow tanks provided allow approximately 5 minutes for operator intervention after activation of a high/high level alarm. The vent piping from individual storage tanks to their respective overflow tank prevents overflow from one storage tank into another. Similarly, the use of separate overflow tanks for each module further reduces the potential for cross contamination. The vent piping from the overflow tanks discharge through vent air scrubbing systems, one for neutral/alkaline storage and one for acid storage, so that:

- potentially noxious vapours and gases are not released inside the building enclosure which houses the storage tanks, and

- ventilation air is treated before being released to the atmosphere.

The inorganic waste storage tanks are of fiberglass reinforced plastic (FRP) construction (to be confirmed during detailed design), of vertical, cylindrical configuration and hopper bottomed, each equipped with an agitator and provided with sample ports. The tank configuration permits the removal of solids, separation of the aqueous phase and blending of the wastes.

Piping for inorganic waste is of fibre reinforced plastic (FRP) construction (to be confirmed during detail design), and configured so as to allow the designation of the modules to be changed according to variations in the waste type received. Permanent tie-ins are provided for the initial designations and blanked and/or valved connections are provided to permit future change of designation.

Six pumpout headers are provided to transfer wastes to the physical/chemical treatment plant. Two headers are designated for acidic waste, two headers for neutral/alkaline waste, one header for aqueous organic - neutral/alkaline and one header for aqueous organic - acidic. Each header is served by two 100% pumps, one operating and one on standby.

Aqueous Organic

Storage for aqueous organic wastes consists of four tanks with a capacity of 40 m^3 each and one 4 m^3 capacity overflow tank. Feed of aqueous organic waste to the storage tanks is from the following sources:

- organic tank truck unloading area (p. 34),
- truck wash station (p. 242)/wash water header, and
- incinerator tank farm (p. 172).

Remote operated valves are provided for directing waste to the designated storage tank, and the inlet valves close at high level to prevent overfilling of the storage tanks. In addition the overflow tank provided allows approximately 5 minutes for operator intervention after activation of a high/high level alarm. The vent piping from individual storage tanks to the overflow tank does not allow overflow from one storage tank into another. The aqueous organic storage tanks are blanketted with nitrogen. The nitrogen is introduced through a pressure valve installed in a common supply line and set to maintain a minimum pressure of about 14 kPa. Vent gas from the storage tanks is piped via the overflow tank to the incinerator tank farm vent system (p. 238).

The aqueous organic waste storage tanks and associated piping are of carbon steel construction. The tanks are of vertical, cylindrical configuration and hopper bottomed, each equipped with an agitator and provided with sample ports. The tank configuration enhances the efficiency of phase separation where required.

Two 100% transfer pumps transfer aqueous organic waste from any one of the four storage tanks plus the overflow tank. Remote operated valves are provided to direct waste to physical/ chemical processing (p. 114) or to the incinerator tank farm (p. 170), as required.

The aqueous organic waste storage tanks and associated equipment are separated from the inorganic waste storage tanks by a solid wall for safety and fire protection purposes as shown on Figure 3.27.

3.7.3.3 Normal Operation

The following describes the operating philosophy that has been established for the incinerator tank farm and physical/chemical storage tank area, consistent with the operating philosophy of the overall Facility.

General

- The operation, supervision and process controls of the storage areas are integrated with the processing systems they serve.

- On-site generated wastes such as wash liquids for the truck wash station, floor washing and equipment flushing, and spills are pumped to the respective storage tank (depending on the type of waste) for processing.

- Primary phase separation (by gravity) to separate immiscible liquids and/or slurries (where required) are carried out in the respective inorganic waste storage tanks.

- Phase separation (by gravity) to separate immiscible liquids and/or organic sludges (where required) are carried out in the respective organic storage tanks.

Operational Safety

The following operational safety features have been included in the design and operation of the tank farm and storage tanks to ensure that they are capable of operating with minimal risk to occupational health and the environment during normal operation:

- All waste storage tanks are vented with vented air from the inorganic storage tanks being scrubbed before it is discharged to the atmosphere and vents from the organic and aqueous organic storage tanks being discharged to the incinerator or to atmosphere via a scrubbing system when the incinerator is not operating.

- The waste storage tanks are located in concrete dykes as required by engineering codes and provide two levels of engineered containment.

- Overflow control design when filling storage tanks reduces the risk of accidental spills. The multiple protection system for spill control includes level alarms, level monitoring systems, actuating feed shut-off valves, overflow piping and overflow collection tanks.

- Certain halogenated organic wastes, with the potential for fugitive emissions of 1,1,1 trichloroethane or similar halogenated hydrocarbons, will be stored in 10 m^3 tanks as required by the buffer zone sizing criteria (Ref: M. M. Dillon Ltd.[14]).

3.7.3.4 Abnormal Operation or Upset Condition

The following outlines the tank farm and storage tank area operating philosophies, safety features and emergency procedures of the process design which contain and minimize any effects resulting from abnormal operation or upset condition.

Spills and Leaks

- Spills or leaks from storage tanks or pumps are contained by provision of curbing, dykes and sumps. Spills are isolated and cleaned up using predetermined safety procedures.

- The inorganic storage tanks are under slight negative pressure due to the ventilation system. This prevents fugitive gaseous emissions from escaping into the physical/chemical storage tank area.

- Gaseous emissions which may escape the collection system are removed from the building by the general ventilation systems.

- The aqueous organic storage tanks in the physical/chemical storage tank area and the organic storage tanks in the incinerator tank farm are blanketted with nitrogen as part of an overall vent system to protect against explosion and fire.

- Gaseous emissions which may escape the vent system are removed by the general ventilation system in respect of the indoor storage tanks and diluted by natural air ventilation in respect of the outdoor storage tanks.

Power Failure

- The plant control and monitoring system is connected to the uninterruptible power supply as soon as the power fails. The ventilation fans and ventilation air scrubbing systems are connected to the emergency power supply.

- On return of normal power, all systems will be restarted in an orderly sequence by the plant operators, once the power is restored.

Fire

- The physical/chemical storage tank area is protected by external hydrants, sprinklers, plus foam deluge for the aqueous organic storage. In addition, fire walls are provided between the aqueous organic and inorganic storage areas.

- The incinerator tank farm is protected by external monitor hydrants.

- The segregated organic storage tank area is protected by external hydrants plus foam deluge spray.

Emergency Procedures

- Escape routes from buildings and platforms are provided at each side of the physical/chemical storage tank area.

- Emergency eyewash and shower stations are provided at strategic locations in the physical/chemical storage tank area.

3.7.4 DRUM STORAGE AND HANDLING

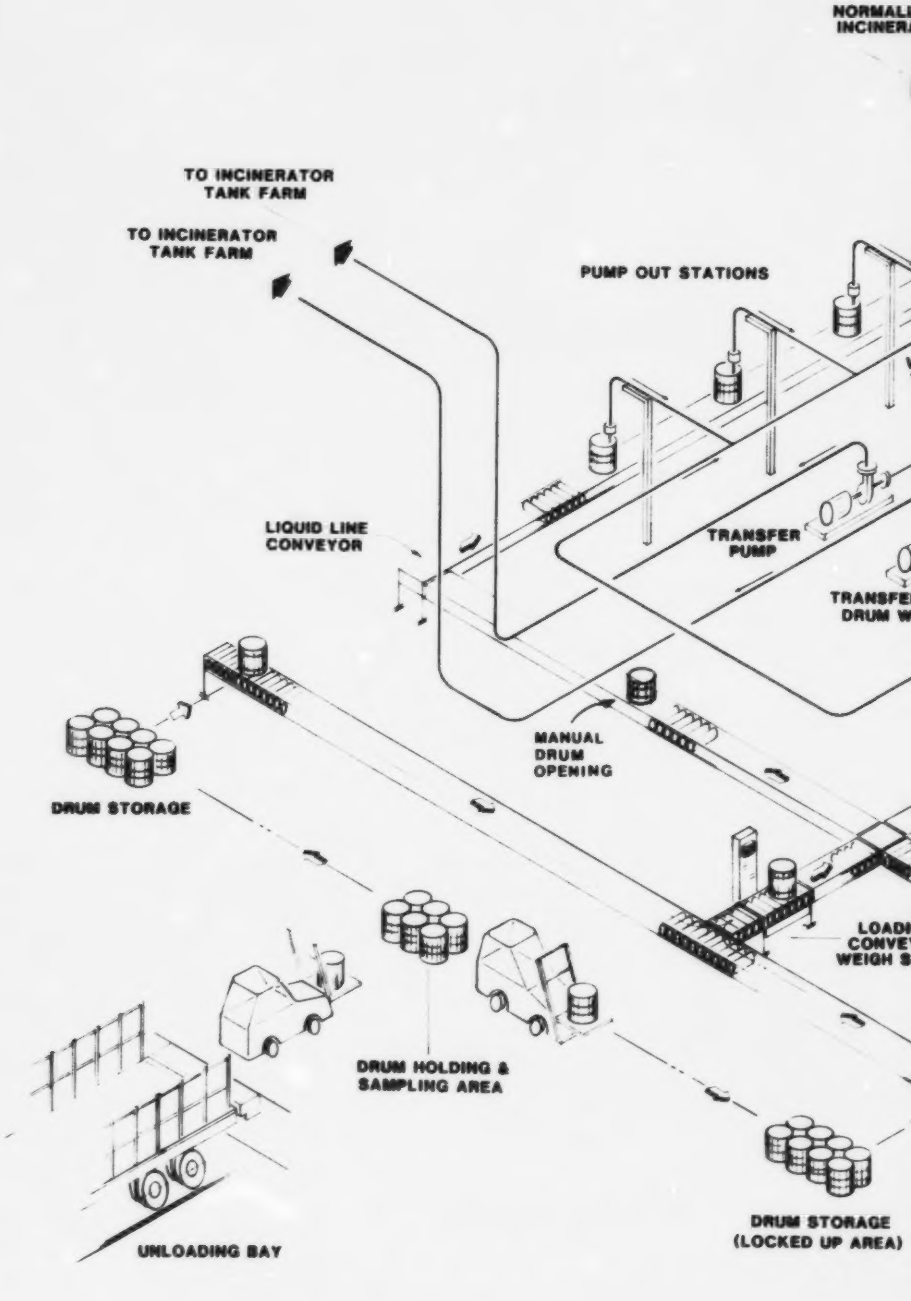
The drum storage and handling facilities comprise segregated storage and handling for the wastes delivered in drums as described in Section 3.2.2 (p. 33). They are segregated into organic and inorganic drum storage and handling buildings.

3.7.4.1 Organic Drum Storage and Handling Building

The organic drum storage and handling building is located between the incinerator tank farm and the incineration plant as shown on Figure 3.2.

Figure 3.30 provides a diagrammatic arrangement of the organic drum handling facility.

Figure 3.31 provides a conceptual equipment layout of the organic drum storage and handling building.


NORMALI
INCINERA
TO INCINERATOR TANK FARM
TO INCINERATOR TANK FARM
PUMP OUT STATIONS
LIQUID LINE CONVEYOR
TRANSFER PUMP
TRANSFE
DRUM W
MANUAL DRUM OPENING
DRUM STORAGE
LOADI
CONVE
WEIGH S
DRUM HOLDING & SAMPLING AREA
UNLOADING BAY
DRUM STORAGE (LOCKED UP AREA)

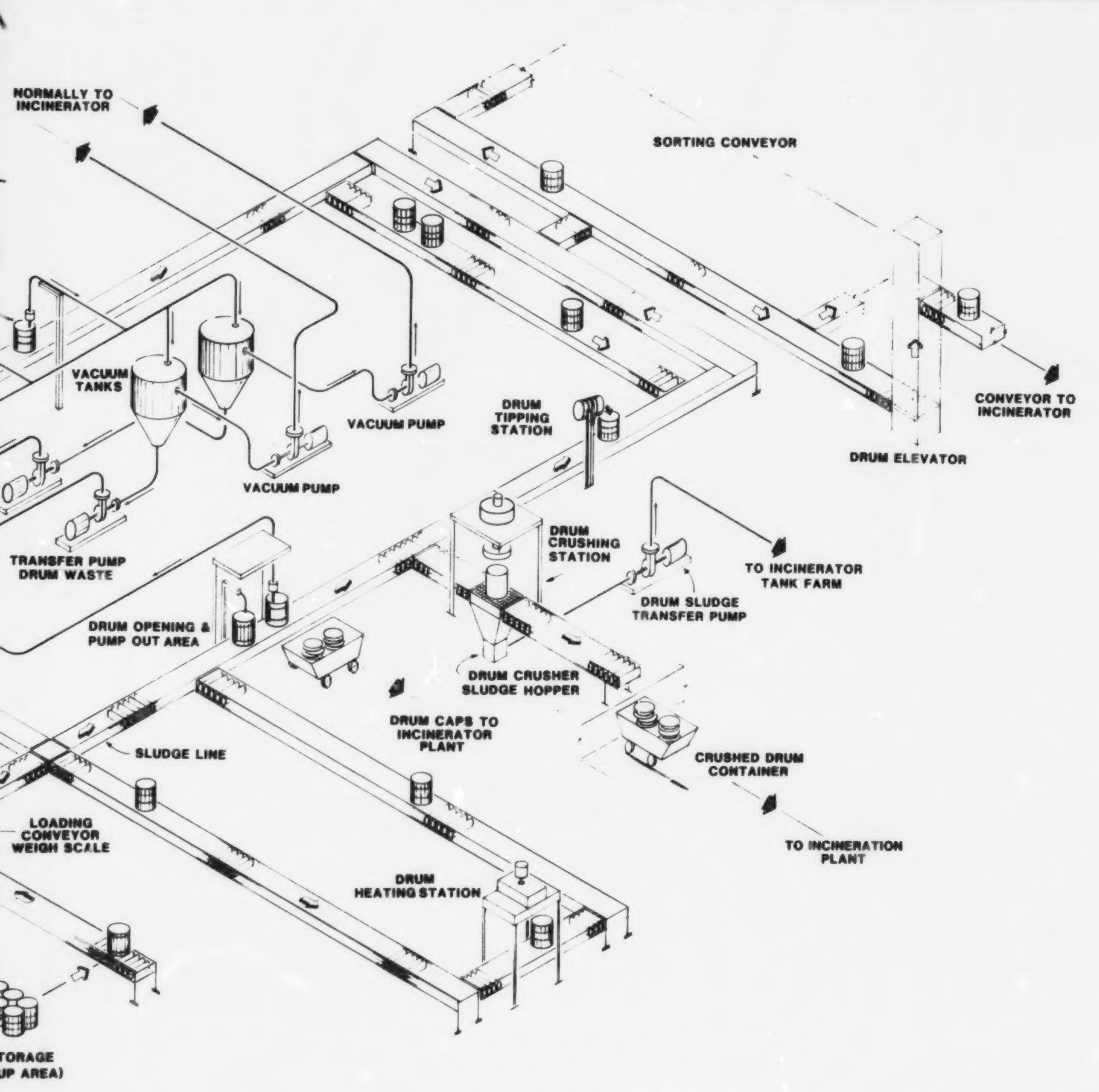
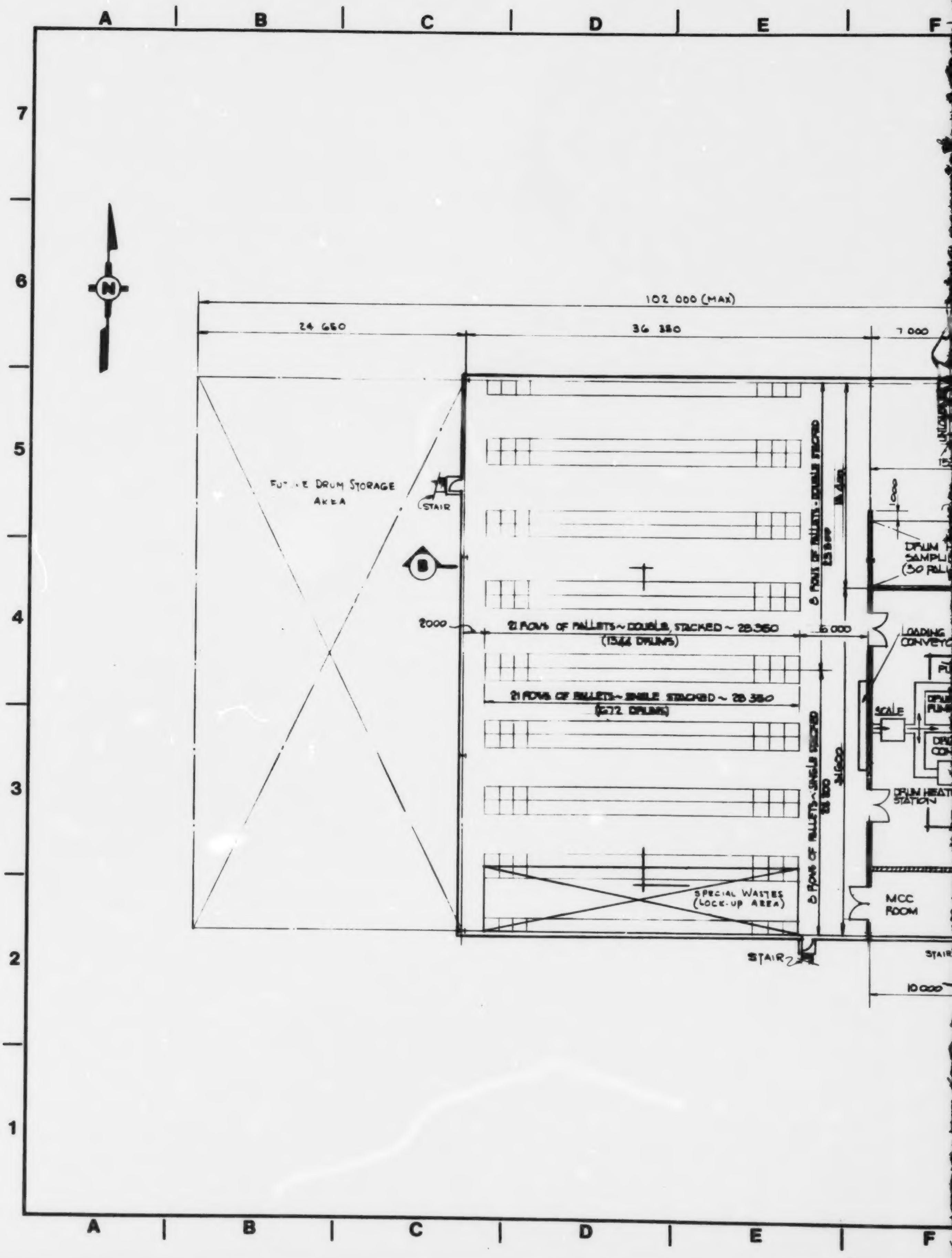
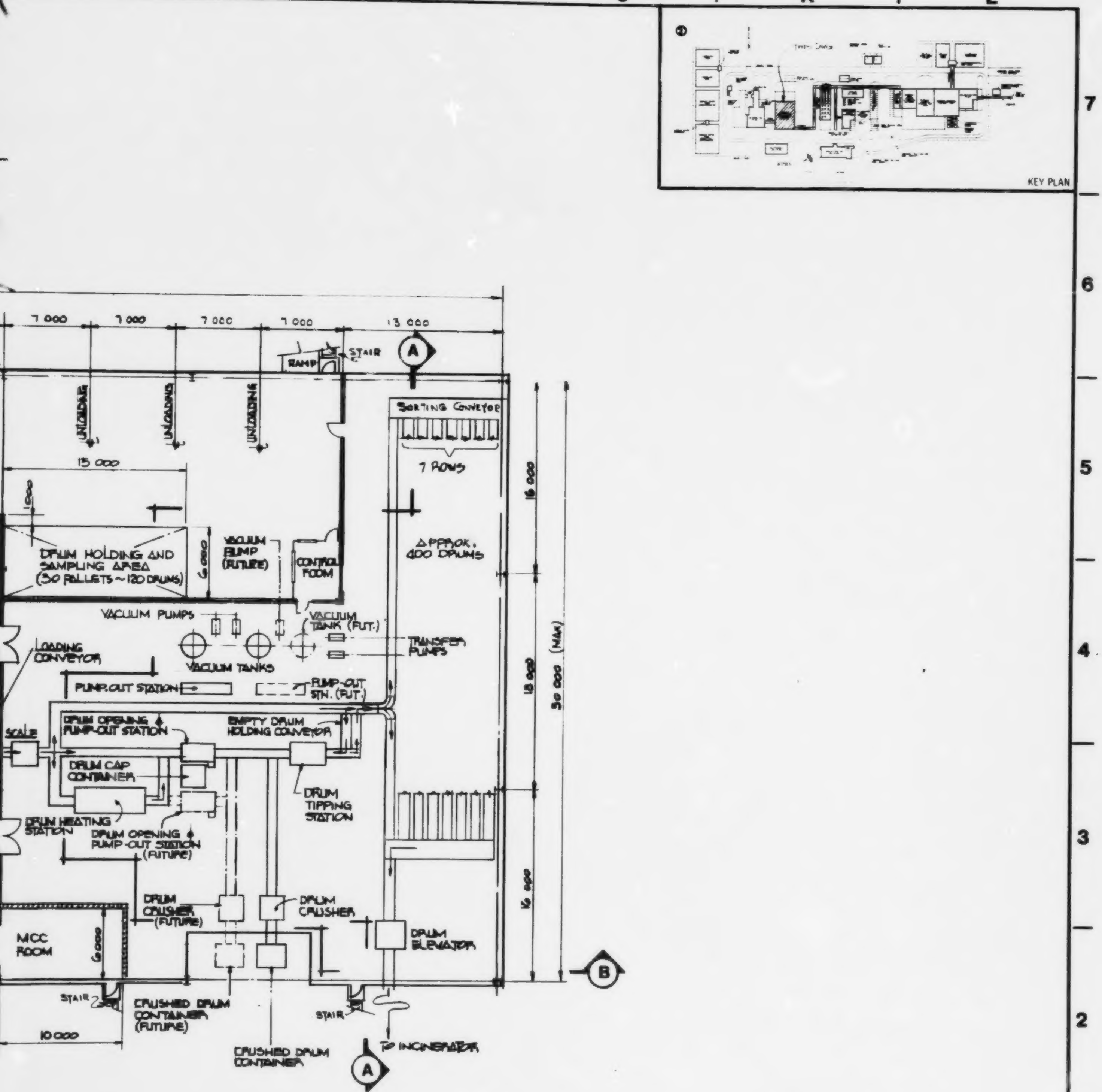

NORMALLY TO INCINERATOR
SORTING CONVEYOR
VACUUM TANKS
VACUUM PUMP
VACUUM PUMP
DRUM TIPPING STATION
CONVEYOR TO INCINERATOR
DRUM ELEVATOR
DRUM CRUSHING STATION
TO INCINERATOR TANK FARM
TRANSFER PUMP DRUM WASTE
DRUM SLUDGE TRANSFER PUMP
DRUM OPENING & PUMP OUT AREA
DRUM CRUSHER SLUDGE HOPPER
DRUM CAPS TO INCINERATOR PLANT
SLUDGE LINE
CRUSHED DRUM CONTAINER
LOADING CONVEYOR WEIGH SCALE
TO INCINERATION PLANT
DRUM HEATING STATION
TORAGE
UP AREA)

FIGURE 3.30

DIAGRAMMATIC ARRANGEMENT OF ORGANIC DRUM HANDLING

A
B
C
D
E
F
7
6
5
4
3
2
1
N
102 000 (MAX)
24 650
36 380
7 000
FUTURE DRUM STORAGE AREA
STAIR
B
2000
21 ROWS OF PALLETS ~ DOUBLE, STACKED ~ 28 350
(1344 DRUMS)
21 ROWS OF PALLETS ~ SINGLE STACKED ~ 28 350
(672 DRUMS)
8 ROWS OF PALLETS - DOUBLE STACKED
23 800
6 000
8 ROWS OF PALLETS ~ SINGLE STACKED
23 100
SPECIAL WASTES (LOCK-UP AREA)
STAIR
1000
DRUM
SAMPLI
(30 PALL
LOADING
CONVEYO
SCALE
DRUM HEAT
STATION
MCC ROOM
STAIR
10 000



F
G
H
J
K
L
7
6
5
4
3
2
1
KEY PLAN
7 000
7 000
7 000
7 000
13 000
A
STAIR
RAMP
UNLOADING
UNLOADING
UNLOADING
SORTING CONVEYOR
7 ROWS
15 000
1 000
DRUM HOLDING AND SAMPLING AREA (30 PALLETS ~ 120 DRUMS)
6 000
VACUUM PUMP (FUTURE)
CONTROL ROOM
APPROX. 400 DRUMS
16 000
18 000
16 000
50 000 (MAX)
VACUUM PUMPS
VACUUM TANK (FUT.)
TRANSFER PUMPS
LOADING CONVEYOR
VACUUM TANKS
PUMP-OUT STATION
PUMP-OUT STN. (FUT.)
SCALE
DRUM OPENING & PUMP-OUT STATION
EMPTY DRUM HOLDING CONVEYOR
DRUM CAP CONTAINER
DRUM TIPPING STATION
DRUM HEATING STATION
DRUM OPENING & PUMP-OUT STATION (FUTURE)
DRUM CRUSHER (FUTURE)
DRUM CRUSHER
DRUM ELEVATOR
MCC ROOM
6 000
B
STAIR
CRUSHED DRUM CONTAINER (FUTURE)
STAIR
10 000
CRUSHED DRUM CONTAINER
TO INCINERATOR
A
F
G
H
J
K
L

FIGURE 3.31

ORGANIC DRUM STORAGE AND HANDLING BUILDING CONCEPTUAL EQUIPMENT LAYOUT PLAN

Drum Unloading

Vehicles carrying drums of organic waste reverse into the unloading bay which is designed to permit simultaneous unloading of two trucks. Forklift trucks are utilized to unload the drums from trucks and are designed to handle both single drums as well as drums on pallets. Drums found to be leaking will be placed into overpack drums.

Drums are placed in a reception area assigned for that particular shipment and then transported by forklift to one of the following:

- storage area,
- special lock-up waste storage area, or
- directly to the loading conveyor.

The storage areas accommodate drums single or double stacked and segregated in accordance with their physical state.

A segregated area with lock-up facility is provided for wastes which need special security arrangements (such as herbicides, pesticides).

Drums are transported from reception and/or storage to the loading conveyor by forklift truck. Once on this conveyor, the drum bung hole or removable top is opened. The release of fugitive emissions from opened drums is reduced by placing a cover over the top of the drums while they are "in transit" in the drum handling facility. The drums are then conveyed via an in-line loading conveyor weigh scale (where the drums are weighed in) and then automatically directed to their preselected drum handling line. Transportation of drums is by conveyor system, with all unit operations being semi-automatic, by a machine under the direct supervision of an operator.

Smaller containers such as bottles or pails will be placed in empty drums(recycled from the pump-out station) and transported to the incinerator via the drum conveying system.

Liquid Line

Drums containing liquids are conveyed by the liquid line conveyor to the drum pump-out stations. Three suction arms, complete with flexible hoses, are used to empty the drum contents into vacuum tanks. Two vacuum tanks are provided for collection of pumpable wastes, one tank used primarily for aqueous organic, the other primarily for organic liquids. However, the piping is arranged such that it is possible to transfer from any pump-out station to either vacuum tank. Once a vacuum tank is filled, the vacuum is broken and the contents transferred to the appropriate storage tank in the incinerator tank farm (p. 168).

Each vacuum tank has a capacity of 15 m^3, is of carbon steel construction, of vertical, cylindrical configuration, hopper bottomed (complete with steam plate coil heater), insulated and vacuum is pulled by a vacuum pump. The contents of the vacuum tank are transferred to the incinerator tank farm using a dedicated drum waste transfer pump.

Organic vapours from the vacuum pump exhaust and the vacuum tank are piped to the front wall of the rotary kiln for disposal (p. 62).

Empty drums are conveyed to the empty drum conveyor for recycling within the Facility, or to the drum sorting conveyor, where they are held, pending transfer to the incinerator.

Drums that cannot be emptied because of sludge or solid residue are transported by forklift to the drum opening station on the sludge line where they are prepared for incineration.

Sludge Line

Drums containing sludge or solid waste are conveyed by the sludge line conveyor to the drum opening station, where drums which do not have manually removable tops have the drum head removed automatically by a spark free cutting tool. A hand held, power assisted drum opener is used for out-of-shape drums. In addition, drums transferred from the liquid line are handled at this location.

The cut drum heads are removed from the drum manually and placed in a container which is periodically transported to the solid waste pit at the incineration plant by forklift truck (p. 54).

Once opened, the drums are inspected visually and a suction arm connected to the vacuum tanks on the liquid line is used to remove liquids which may have accumulated on top of the solid waste or sludge. The release of fugitive emissions is minimized by placing a cover over the top of the drums while they are "in transit" in the drum handling facility.

Drums containing pumpable sludge are conveyed to the drum crushing station, where the drums are crushed automatically by a hydraulic ram. The sludge is pressed through a grid into a sludge hopper located underneath. Crushed drums are collected in a container which is periodically emptied into the solid waste pit at the incineration plant (p. 54). This will be reviewed during detailed engineering.

Sludge is pumped to the organic sludge storage tanks at the incinerator tank farm using the drum sludge transfer pump.

Drums containing solid waste are conveyed to the drum sorting conveyor, where they are held, pending transfer to the incinerator.

Drums that contain highly viscous or non-pumpable organic wastes which may cause heat peaks in the incinerator due to their highly combustible nature are conveyed to the drum tipping station. The drum is then partially emptied by tipping some of its contents into an empty drum or drums from the empty drum conveyor. The partially filled drums are then conveyed to the drum sorting conveyor, where they are held, pending transfer to the incinerator.

Off-Line

Drums containing highly viscous or wax like materials are conveyed by the off-line conveyor to the drum heating station. The heating station has two independent sections with separate conveyors and doors and each section designed to heat eight drums simultaneously.

After heating to the required temperature, drums are then conveyed to the drum opening station on the sludge line and then to the appropriate processing station.

Drum Sorting Conveyor

The drum sorting conveyor comprises an array of 7 conveyors, each with a storage capacity of 50 drums. Drums of waste having the same or similar characteristics will be stored on the same conveyor, and some conveyor(s) may contain empty drums ready for disposal by incineration.

A shuttle conveyor reclaims drums from the sorting conveyors in a predetermined sequence established by the incineration plant operator. The drums are then elevated by the drum elevator and conveyed to the incinerator feed chute prechamber (p. 60).

3.7.4.2 Inorganic Drum Storage and Handling Building

The inorganic drum storage and handling building is located between the inorganic tank truck unloading area and the physical/chemical storage tank area as shown on Figure 3.2.

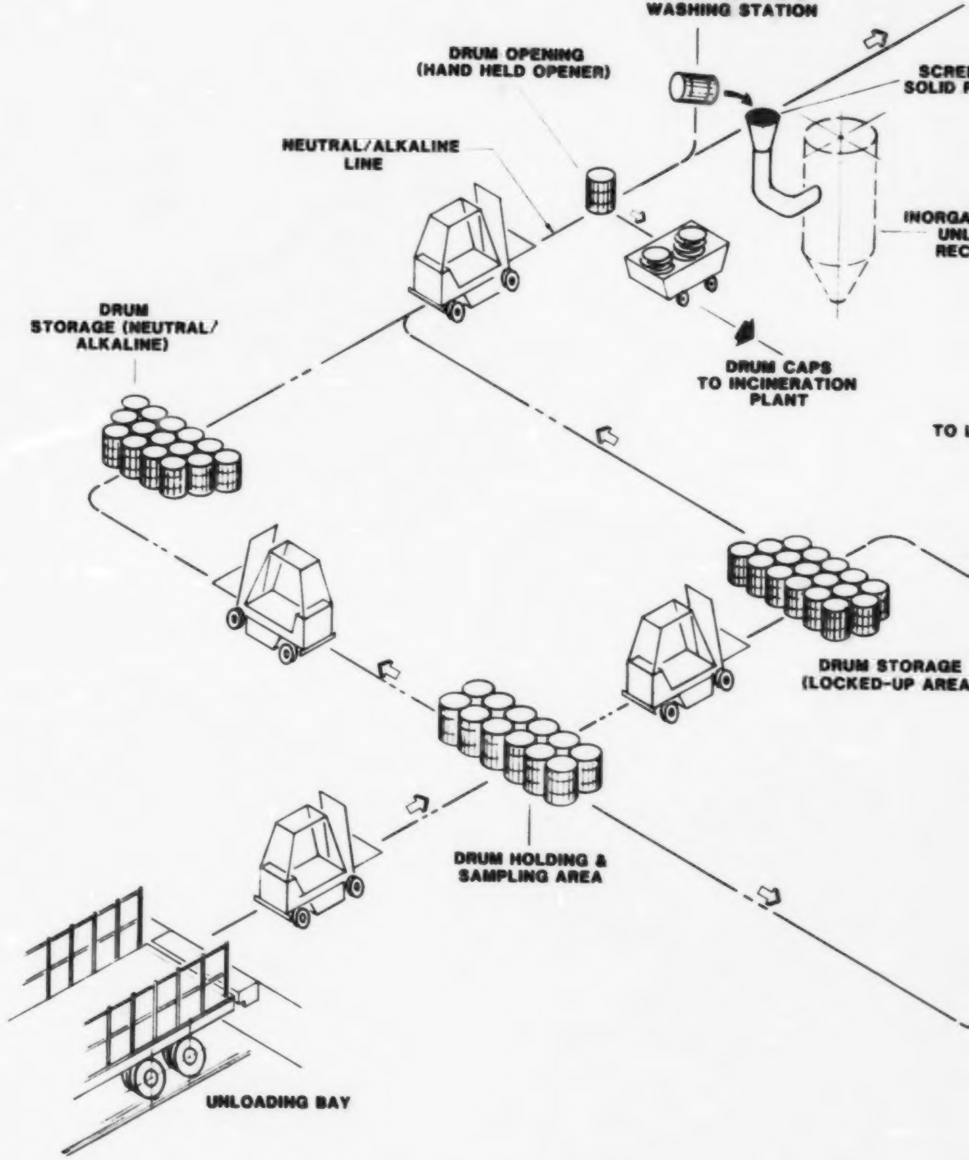
Figure 3.32 provides a diagrammatic arrangement of the inorganic drum handling facility.

Figure 3.33 provides a conceptual equipment layout of the inorganic drum storage and handling building.

Drum Unloading

Vehicles carrying drums of inorganic waste reverse into the unloading bay which is designed to permit simultaneous unloading of two trucks. Forklift trucks are utilized to unload drums from trucks and are designed to handle both single drums as well as drums on pallets. Drums found to be leaking will be placed into overpack drums.

Drums are placed in a reception area assigned for that particular shipment and then transported to one of the following:


DRUM TIPPING &
WASHING STATION
DRUM OPENING
(HAND HELD OPENER)
SCRE
SOLID F
NEUTRAL/ALKALINE
LINE
INORGA
UNL
REC
DRUM
STORAGE (NEUTRAL/
ALKALINE)
DRUM CAPS
TO INCINERATION
PLANT
TO I
DRUM STORAGE
(LOCKED-UP AREA
DRUM HOLDING &
SAMPLING AREA
UNLOADING BAY

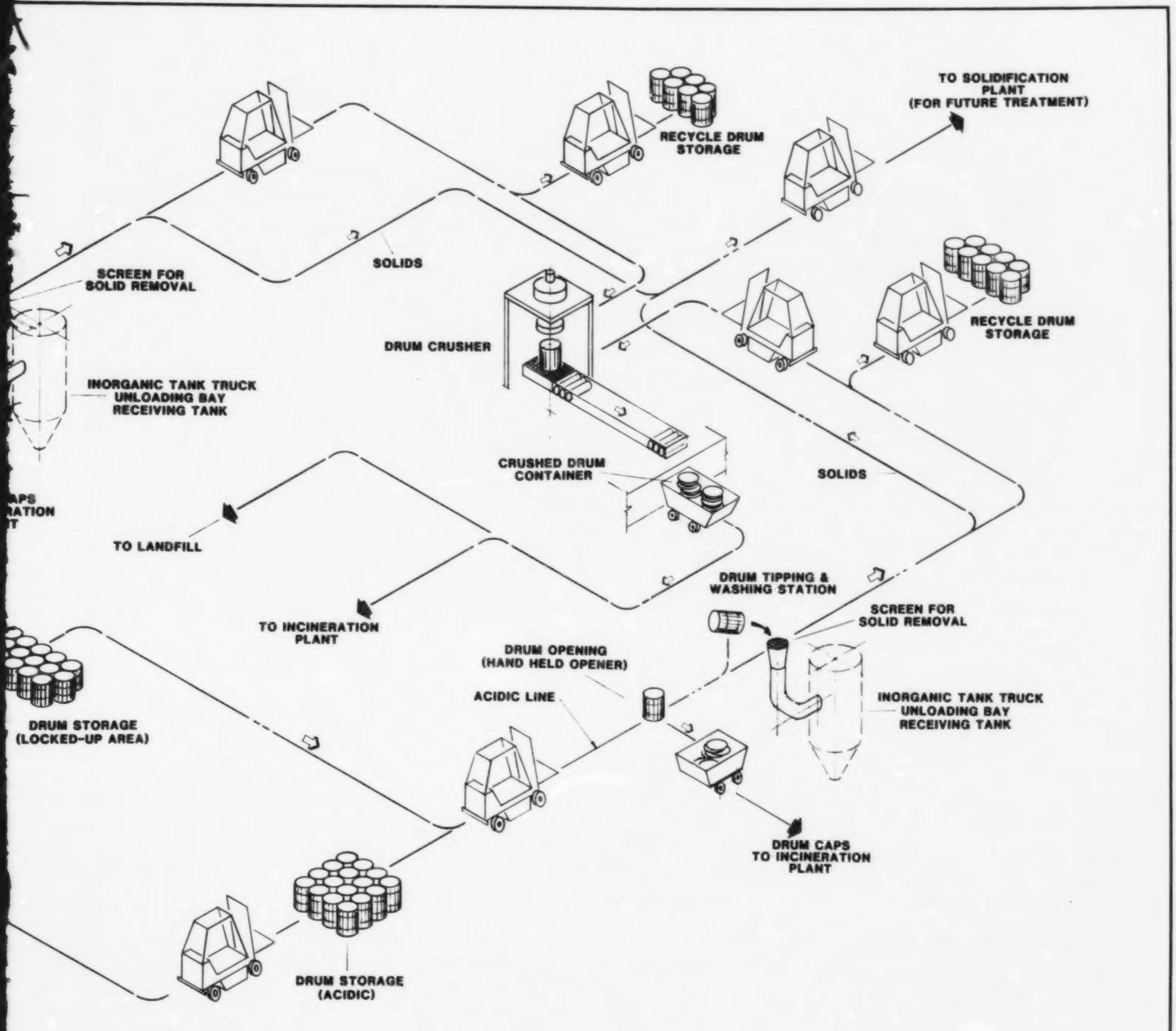
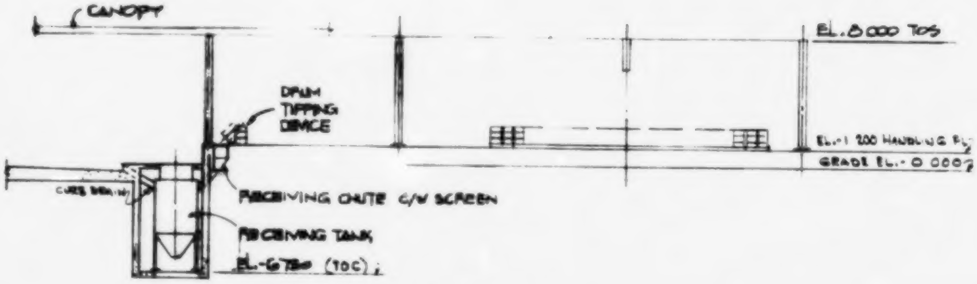
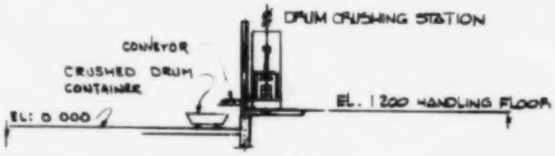

TO SOLIDIFICATION PLANT (FOR FUTURE TREATMENT)
RECYCLE DRUM STORAGE
SOLIDS
SCREEN FOR SOLID REMOVAL
DRUM CRUSHER
INORGANIC TANK TRUCK UNLOADING BAY RECEIVING TANK
RECYCLE DRUM STORAGE
CRUSHED DRUM CONTAINER
SOLIDS
TO LANDFILL
DRUM TIPPING & WASHING STATION
SCREEN FOR SOLID REMOVAL
TO INCINERATION PLANT
DRUM OPENING (HAND HELD OPENER)
ACIDIC LINE
INORGANIC TANK TRUCK UNLOADING BAY RECEIVING TANK
DRUM STORAGE (LOCKED-UP AREA)
DRUM CAPS TO INCINERATION PLANT
DRUM STORAGE (ACIDIC)

FIGURE 3.32

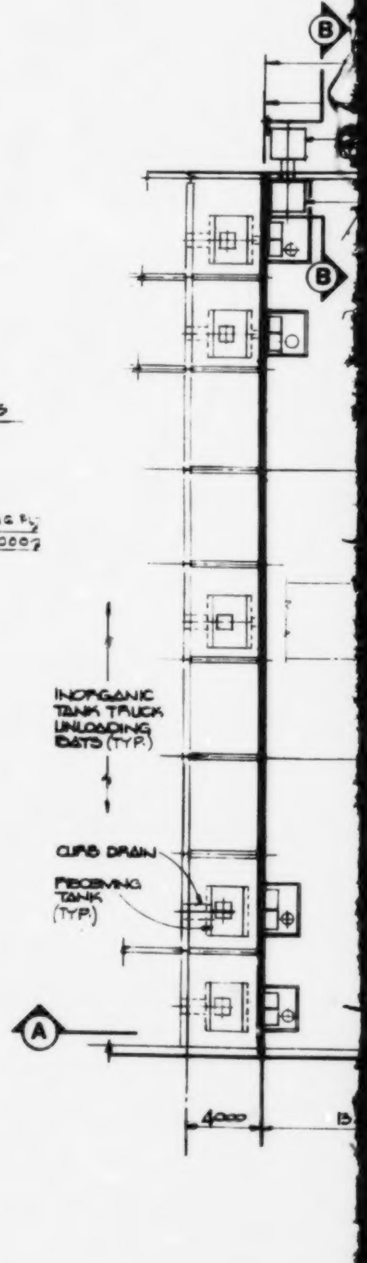
DIAGRAMMATIC ARRANGEMENT OF INORGANIC DRUM HANDLING

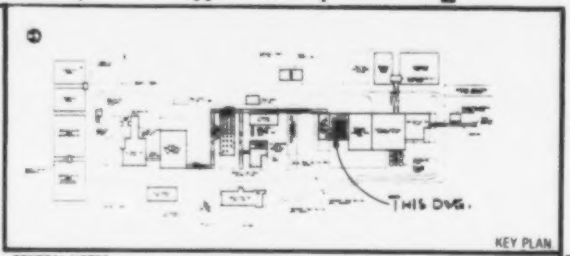

CANOPY
EL. 8 000 TOS
DRUM TIPPING DEVICE
EL. 1 200 HANDLING FL
GRADE EL. 0 000
CURB DRAIN
RECEIVING CHUTE C/W SCREEN
RECEIVING TANK
EL. -6 750 (TOC)

SECTION 'A-A'


DRUM CRUSHING STATION
CONVEYOR
CRUSHED DRUM CONTAINER
EL. 0 000
EL. 1 200 HANDLING FLOOR

SECTION 'B-B'


B
B
INORGANIC TANK TRUCK UNLOADING BAYS (TYP.)
CURB DRAIN
RECEIVING TANK (TYP.)
A
4000


THIS DWG.
KEY PLAN

GENERAL NOTES

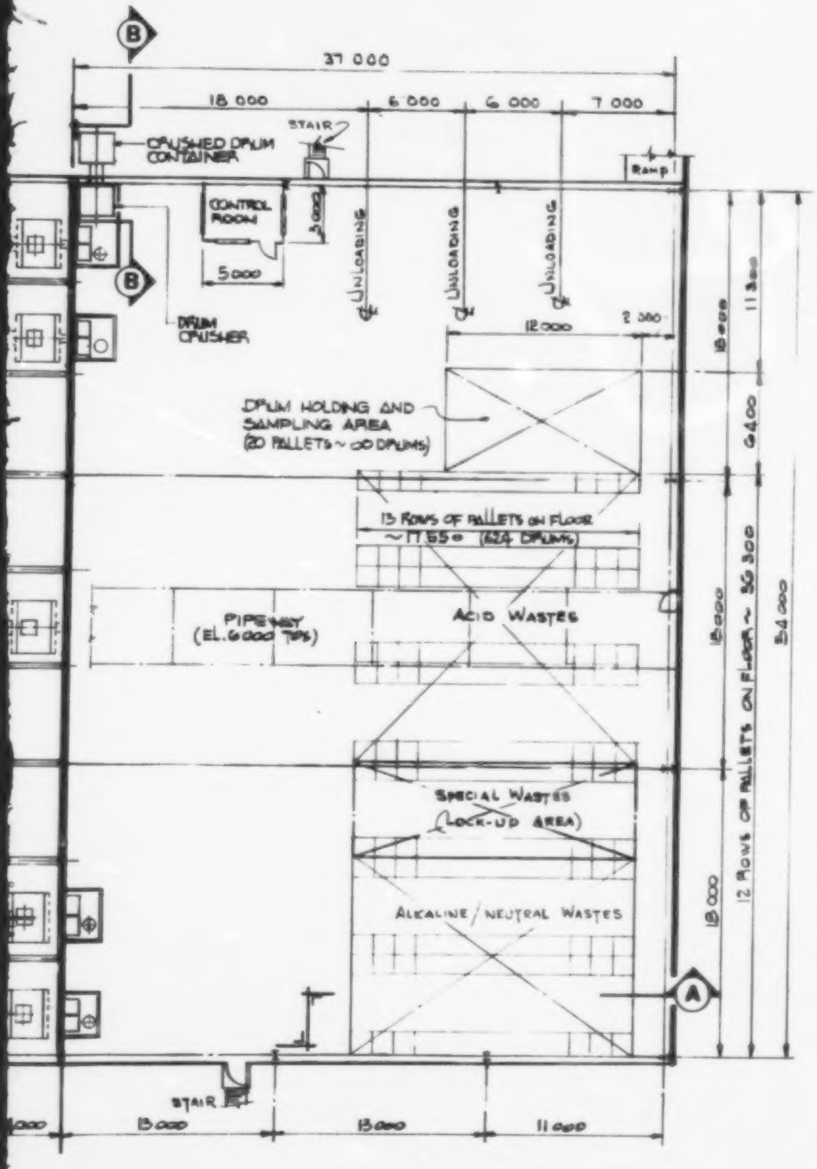

F
G
H
J
K
L
7
6
5
4
3
2
1
B
37 000
18 000
6 000
6 000
7 000
STAIR
CRUSHED DRUM CONTAINER
RAMP
CONTROL ROOM
3000
5000
UNLOADING
UNLOADING
UNLOADING
B
DRUM CRUSHER
12 000
2 300
18 000
11 300
DRUM HOLDING AND SAMPLING AREA (20 PALLETS ~ 80 DRUMS)
6400
13 ROWS OF PALLETS ON FLOOR ~17 550 (624 DRUMS)
PIPEWAY (EL. 6000 TPS)
ACID WASTES
18 000
12 ROWS OF PALLETS ON FLOOR ~ 35 300
54 000
SPECIAL WASTES (LOCK-UP AREA)
ALKALINE / NEUTRAL WASTES
18 000
A
STAIR
1000
13 000
13 000
11 000

FIGURE 3.33

INORGANIC DRUM STORAGE AND HANDLING BUILDING CONCEPTUAL EQUIPMENT LAYOUT PLAN AND SECTIONS

- neutral/alkaline waste storage area,
- acidic waste storage area,
- special lock-up waste storage area,
- directly to their respective processing line, or
- directly to the solidification plant for further treatment.

The storage areas accommodate drums single or double stacked.

Small containers such as bottles or pails will be placed in empty drums (recycled from the washing station).

Drum Emptying

Drums are transported from storage to their appropriate processing line (neutral/alkaline or acidic) by forklift truck. Each processing line comprises a drum opening station and a drum tipping and washing station.

At the drum opening station, the drums are opened either by removing the ring-top lid or cutting off the top of the drum, using a portable hand held opener. The drum lid or top is removed manually and placed in a container which is periodically transported to the solid waste pit of the incineration plant by forklift truck (p. 54).

The opened drums are then moved to the drum tipping and washing station. The contents of the drums are emptied into the in-ground unloading tanks associated with the inorganic tank truck unloading area (p. 39). Two of the unloading tanks are used for neutral/alkaline waste and two for acidic wastes. These unloading tanks are equipped with receiving chutes and a basket screen for removing gross solids.

The drums are emptied utilizing a drum tipper to turn the drum upside down and empty the contents down the receiving chute. A high pressure stream of water is then directed up into the empty drum to dislodge any remaining waste adhering to the inside of the drum; the rinse water falling into the same unloading tank as the waste.

The empty drums are transported by forklift truck to their respective recycle drum storage or to a common drum crusher. Drums are crushed automatically and then collected in a container which is periodically emptied into the solid waste pit at the incineration plant (p. 54).

3.7.4.3 Normal Operation

The following outlines the drum storage and handling facilities operating philosophies and safety features which ensure that the plant performs as expected and operates in a safe, environmentally sound manner.

General

- The drum storage and handling facilities will normally operate 8 hours per day, 5 days per week, 50 weeks per year.
- During unloading, drums will be inspected for damage, leakage etc., and any drum not considered to be in satisfactory condition will be placed in an overpack drum.
- Each consignment of drums will be placed in a reception area assigned for that particular shipment.
- The drums will then be checked with the shipping list and necessary samples will be taken by the laboratory for verification of the contents of the drums.
- After confirmation that the waste meets specification, the drums will be marked for identification and moved to a designated storage area to await processing.
- Drummed waste will be processed in batches of similar wastes.

Operational Safety

This section identifies the main safety features that are incorporated in the design to ensure that both human and environmental safety is achieved at all times.

- The release of fugitive emission from opened drums is reduced by placing a cover over the top of the drums while they are "in transit" in the drum handling facility.

- The drum storage and handling buildings have two levels of ventilation, namely the storage areas which do not require a high level of ventilation and the drum sampling and active processing areas which require a high level of ventilation.

- Vent gases from the vacuum tanks are routed to the incinerator in the case of the organic drum storage and handling building or to a supplementary treatment system when the incinerator is down.

- Ventilation air from the drum sampling and active process of the inorganic drum storage and handling building is routed to a two stage emission control system.

3.7.4.4 Abnormal Operation or Upset Condition

The following outlines the drum storage and handling facilities operating philosophies and safety features of the process design which minimize the effects resulting from abnormal operation or upset conditions.

Spills and Leaks

- Minor spills or leaks from tanks or pump seals are contained for clean up by curbing around the base of the equipment. In addition, pumps are equipped with an integral base plate/drip pan.

- All floor areas of the drum storage and handling facilities are sloped to floor drains leading to sumps.

- Gaseous emissions which may escape the processing area ventilation systems are removed from the building by the general ventilation systems.

Power Failure

- The drum storage and handling facilities control and status monitoring system is connected to an uninterruptible power supply The ventilation fans and ventilation air cleaning systems are connected to the emergency power supply.

- On return to normal power, all systems will be restarted in an orderly sequence by the plant operator, once power is restored.

Fire

The following fire protection features have been incorporated into the drum storage and handling facilities:

- Organic Drum Storage and Handling Building
  - External hydrants, foam sprinklers and portable "Halon" for the control room.

- Inorganic Drum Storage and Handling Building
  - External hydrants, sprinklers and portable "Halon" for the control room.

Emergency Procedures

- Escape routes and exit doors are provided from all sides of the buildings.

- Emergency eyewash and shower stations are provided at strategic locations in the buildings.

3.7.5 UTILITIES, SERVICES AND BUILDINGS

Site services are generally considered "off-site" and consist of utilities supplied to the site, or discharged from it. Utility systems consist of services distributed throughout the site to supply the needs of the process areas and ancillary buildings.

3.7.5.1 Site Services

The site services supplied to or discharged from the site are:

- raw water supply,
- storm water discharge,
- auxiliary fuel supply, and
- electrical power supply.

Raw Water Supply

Raw water will be supplied to the site from the Welland River via a buried pipeline up Heaslip Road as shown on Figure 3.4, subject to approval from the Ontario Ministry of the Environment (to be confirmed during detailed design).

A pumphouse will be located at the Welland River. Water is drawn through a bar screen and travelling screen to three 50% pumps. The pumps discharge the raw water into the raw water reactor clarifier package on the site.

The raw water supply pumps operate automatically, controlled by the water level in the treated water storage basin (p. 201).

The bar screen prevents any large object from entering the pumphouse and does not normally require any operator attention. The travelling screen, upstream of the pump suctions removes any debris that is too large for the pumps to pass. If the screen becomes partially clogged, it rotates to expose a clean section of screen, and the debris is automatically removed.

Storm Water Discharge

Storm water is discharged off-site to the Welland River via a buried gravity sewer down Heaslip Road as shown on Figure 3.4 subject to approval from the Ontario Ministry of the Environment. The design flow is estimated at 7 000 m^3/h, for periods when storm water is being discharged, and this flow is accommodated by a 48 inch nominal diameter pipe.

Auxiliary Fuel

Auxiliary fuel (natural gas) is required for start-up, shut-down and combustion support purposes in the rotary kiln incinerator (p. 58) as well as for the auxiliary boilers (p. 79). Natural gas will be provided to the site by the Provincial Gas Company from Vineland, via a pipeline down Regional Road 24 and Highway 20 (to be confirmed during detailed design).

No. 2 fuel oil (distillate) is required for the standby diesel generators in the emergency power station and for the diesel driven fire pumps in the fire water pumphouse on site. This No. 2 fuel oil will be delivered by road tanker and unloaded at the respective building into local storage tanks (pp 220, 232) using the road tanker's chassis mounted pump.

Electrical Power

Electrical power will be supplied to the site from a 115 kV power line tapped off Ontario Hydro 115 kV Q2A circuits, which supplies Dunnville Transformer Station, and will be brought into OWMC's main substation as shown on Figures 3.2 and 3.4. The actual powerline route will be established by Ontario Hydro from separate studies. The load is presently estimated at approximately 10 MVA.

3.7.5.2 Utility Systems

The utility systems distributed throughout the site are:

- compressed air,
- steam and condensate,
- water systems including treatment,
- sanitary sewage collection and treatment,
- cooling water, and
- surface drainage.

Compressed Air

The purpose of the compressed air system is to provide clean, dry, oil free air for instrument and plant air.

Instrument air is distributed around the Facility via the instrument air header for pneumatic instrumentation and controls.

Plant air is distributed around the Facility via the plant air header to the various utility stations located around the Facility for air operated equipment and tools and to the physical/chemical treatment plant for process air.

The compressed air system comprises three oil free air compressors, an air reservoir and two air drier packages, each with dual dessicant driers. A plant air reservoir is located in the incineration plant and an instrument air reservoir and second plant air reservoir are located in the physical/chemical treatment plant.

Each compressor supplies 50% of the maximum air requirements and operates automatically. One compressor provides the base load of air and a second unit starts automatically when the demand exceeds the output of the base load compressor. If the load exceeds the output of both compressors or one of the compressors fail, the third compressor starts automatically. The compressors are started and stopped by pressure switches on the air supply. If the air pressure falls, the demand for air is exceeding the supply capacity and the next compressor starts.

The air drier packages are operated in parallel, with one of the driers in each package being regenerated or on standby while the other is in service. When the dewpoint of the air reaches - 40°C, the standby drier goes into service, the other drier being taken out of service and regenerated automatically. Once its regeneration is complete, this drier goes into standby until it is required again. Air filters are provided upstream and downstream of each drier package.

Steam and Condensate

The purpose of the steam and condensate system is to generate and distribute all steam required on site and collect and recover the majority of clean condensate to minimize make-up requirements.

Steam is generated by the waste heat recovery boiler and auxiliary boilers at 2750 kPa and 300°C with a pressure reducing station and desuperheating station to reduce this to 450 kPa and 10°C superheat for low pressure purposes (p. 79).

The final operating pressure(s) and temperature(s) will be established during detail design on completion of studies and evaluations of the overall steam system.

Condensate is recovered and returned to the boiler via the clean condensate or potentially contaminated headers depending on the service requirements (p. 80).

Water Systems Including Treatment

Raw water will be pumped from the Welland River to the site (p. 198) and then treated by chlorination, clarification and filtration. The filtered water is stored in the treated water storage basin prior to distribution and further treatment as required.

Raw Water Treatment. The raw water pumps (p. 198) discharge the raw water through a buried pipeline up Heaslip Road into the raw water clarifier located in the raw water treatment plant (see Figure 3.2).

The raw water flows by gravity through the reactor clarifier package and sand filter units into the treated water storage basin, from which it is pumped to the different users. Chemicals such as aluminum sulphate (alum), polyelectrolyte and pulverized clay are used to clarify the water, which is also chlorinated using sodium hypochlorite.

The raw water supply and treatment systems normally operate automatically and, except for making up some chemicals and periodic checking and testing, the system does not require operator intervention.

The raw water supply pumps in the pumphouse at the Welland River are controlled by levels in the treated water storage basin; starting on low level and stopping on high level. The bar screen at the pumphouse prevents any large objects from entering the pumphouse and does not normally require any operator attention. The travelling screen upstream of the pumps removes any debris that are too large for the pumps to pass. If the screen becomes partially clogged it rotates to expose fresh screen and the debris is automatically removed.

The water flows through the clarifier and into the filters by gravity. Most solids settle out and are removed as a sludge in the clarifier, with the clear water flowing to the filter. The chemical feed systems automatically add the correct concentration of chemicals to cause the coagulation, flocculation and clarification reactions to take place. The chemical feed pumps start and stop with the raw water pumps and add the chemicals at a preset rate. The water flow rate through the clarifier is set by the operator and should not normally require adjustment.

The clarifier, sludge scraper and sludge recirculation systems operate continuously. Any sludge from the clarifier is discharged, based on the total feed to the clarifier, to a sludge basin and is pumped to a tank truck periodically for treatment and disposal in the physical/chemical treatment plant. The operator must initially connect the discharge hose and start the pump, which stops automatically on low level in the sump.

The clarifier water flows down through the sand in the filter and into the storage basin by gravity. The sand collects any solids, which are removed by backwashing the filter. The backwash is automatically initiated either by total flow through the system or high differential pressure across the sand bed, indicating it is full of solids; return to service also being automatic. The water used for the backwash is collected in the filter backwash basin and pumped back to the clarifier at a low flow rate. The backwash return pumps start automatically on high level and stop on low level in the filter backwash basin.

The raw water flowing into the clarifier and the filtered water flowing into the treated water storage basin are chlorinated by adding sodium hypochlorite. The metering pumps' flow rate is adjusted to give the required dosage and the pumps start and stop with the raw water pumps feeding the clarifier.

The treated water storage basin holds filtered water which is pumped to different users as required by their system demands.

Treated water is pumped from the treated water storage basin to the various water systems on-site as follows:

- Fire pond make-up (p. 232) and heating, ventilating and air conditioning (HVAC) cooling water make-up.
- Make-up to the service water system.
- Potable water system and make-up to the clarifier clay dosing package (for slurrying the pulverised clay) and the clarifier polyelectrolyte dosing package (for preparing the polyelectrolyte solution).
- Make-up to the demineralization trains associated with the steam and condensate system (p. 81).

Service Water. Service water is required for process, flushing and general requirements throughout the Facility. The primary source of service water is recycle water from the physical/chemical treatment plant (p. 114) with a secondary source of treated water from the treated water storage basin.

The service water system has a service water storage tank and two 100% service water distribution pumps sized to distribute all required service water. Physical/chemical recycle water from the recycle water pond is added and any extra water requirements are supplied from the filtered water storage basin of the raw water treatment plant.

The service water system normally operates automatically and, except for periodic checking, the system does not require any operator intervention.

The service water will be used for flushing and process water as required. One of two 100% pumps is used to deliver water from storage to the service water header as required.

Water addition to the service water tank is controlled by the level in the tank, with physical/chemical plant recycle water from the recycle water pond being added to maintain the level. If the level falls to a low value and there is no recycle water available then water is added from the raw water treatment filtered water storage basin.

Potable Water. Potable water is required for use by personnel as well as eyewash/safety showers and all sanitary facilities. It must meet all Ministry of Health and MOE requirements for potable water quality and be available even in the event of a power failure.

The potable water system is supplied from the treated water storage basin by one of three 100% potable water pumps which discharge into a pressurized surge tank to even out peak flows from the system.

Drinking water will be available from bottle dispensers.

The potable water system operates automatically and, except for periodic checking and testing, it does not require any operator intervention.

The water is pumped into a pressurized storage tank from the raw water treatment system filtered water storage basin by pumps controlled by the level in the storage tank. Sodium hypochlorite is injected into the water as it is being added to the storage tank to maintain the correct residual chlorine in the system.

The pressurized storage tank is controlled at approximately 60 psig by adding compressed air to the tank, which supplies the potable water header.

Sanitary Sewage Collection and Treatment

The purpose of this system is to collect and treat all sanitary wastes produced on site.

The sanitary sewage is collected by gravity in one of two package unit pumping stations and then pumped by buried pipeline to a package sewage treatment plant on-site.

The sewage treatment plant consists of an aeration tank with two 100% blowers and a number of non-clog aerators, a clarifier to remove any sludge, and a chlorination system designed to add sodium hypochlorite to maintain a residual chlorine.

The treatment plant also has a surge tank, two 100% pumps to pump the effluent to disposal and an aerated sludge digestor to store and break down some of the excess sludge prior to disposal. The aerobic digestor takes air from the aeration tank blowers.

The sanitary sewage collection and treatment systems operate automatically and only require operator intervention for testing and routine maintenance.

There are two pumping stations to collect all sanitary sewage produced in the central operating area. The different sanitary facilities discharge by gravity sewer into the wet well of one of the pumping stations, from which pumps deliver the collected sewage to the sewage treatment plant, based on the level in the wet well.

The sewage will be pumped to an aeration basin where biologically activated sludge will react with the sewage, collect any solids and break down any organic matter into carbon dioxide, water and more biologically active sludge. Air will be added to the aeration basin to keep the microbial population alive.

The contents in the aeration basin overflow into a clarifier. The sludge that settles out is discharged back to the aeration basin and the clean liquid overflows into the chlorination chamber.

Sodium hypochlorite is added to the chlorination chamber to disinfect the effluent from the clarifier. The sodium hypochlorite is added from a metering pump that starts when there is a flow to the sewage treatment plant and stops when there is no flow.

The chlorinated effluent overflows into a holding tank from which it is pumped to final disposal based on the level in the tank.

Extra biological sludge produced in the aeration basin is pumped into an aerobic digestor where it is aerated and approximately 50% of the sludge breaks down. Periodically the sludge in the aerobic digestor is pumped to a tank truck for disposal.

Cooling Water

The purpose of this system is to circulate cooling water as required on-site and to remove any heat added.

The cooling water system has two 100% pumps to recirculate cooling water through the process units and some air conditioning systems in their areas. This cooling water then passes through the cooling water heat exchanger to remove any excess heat using water from the firewater pond as a cooling medium. Water from the firewater pond is recirculated by one of two 100% pumps through the heat exchanger and back into the firepond, which acts as a natural cooling pond by discharging heat to the atmosphere.

The firewater pond does not have sufficient cooling capacity for all of the cooling water on site, therefore some of the water for air conditioning will be cooled using other means.

The cooling water system operates automatically and only requires operator intervention for routine maintenance.

Since some of the heat in the firewater pond is removed by evaporation the level of the pond is maintained by adding treated water from the treated water storage basin.

Surface Drainage

The purpose of the surface drainage system is to provide facilities to manage the surface runoff from precipitation, firewater, road wash and spillage in the central operating area. The landfill drainage system is collected and managed in a separate system (p. 165).

The uncontaminated surface drainage system collects runoff from clean areas where there is no operating equipment, waste or chemicals, such as building roofs.

The potentially contaminated system collects runoff from roads and other areas without operating equipment such as pumps. This system could become contaminated by an accident such as a spill from a tank truck or a fire.

The contaminated system collects runoff from areas with outdoor operating equipment such as pumps that may leak during normal operations.

The potentially contaminated and the uncontaminated systems operate in a similar manner. Each sewer system collects any runoff, which is normally from a rainfall, and discharges it into its respective surface water pond by gravity. Other than for periodic inspection, the sewers do not require any operation.

The potentially contaminated and uncontaminated surface water ponds also operate in the same manner and both are normally empty. After rainfall runoff has collected, the contents of the pond are sampled and analysed to determine if the contents are contaminated. If uncontaminated, the water is pumped by one of two 100% pumps to the sewer down Heaslip Road and discharged into the Welland River. If contaminated, the contents are pumped to the physical/chemical treatment plant for treatment in the miscellaneous waste treatment system.

The flow rate and total flow of water being pumped to the Welland River is measured, sampled and monitored on-line for conductivity, pH, turbidity and hydrocarbon content. If any of these parameters fall outside preset limits, the system alarms and the flow to the river is stopped. This on-line monitoring is primarily for record purposes and as a backup to the original sampling done prior to discharge.

The ponds are constructed with a double liner, so that any groundwater that may rise to the bottom of the liners is collected and pumped automatically into its respective pond. The flow is measured to give the total quantity of groundwater collected.

The layer between the two liners also has a system to collect any water accumulating between the liners. This water is also pumped into its respective pond and the flow measured, although any water detected here activates an alarm to indicate that there may be a problem with one of the liners.

If one of the surface water ponds has a damaged liner, its sewer system is blocked and any flow diverted to the other pond to allow repairs. The single pond holds approximately one month's average rainfall from both systems.

The contaminated surface drainage system is located in the incinerator tank farm including the incinerator receiving tanks and auxiliary fuel oil tanks. The drainage from the curbed area around the pumps is collected and discharged directly into a sump sized to hold normal storm flows, although it does not hold the flow from a major fire. On high level the contents in the sump overflow to the potentially contaminated sewer system.

After rainfall runoff has collected, the contents in the sump are sampled and, if clean, the water is pumped to the potentially contaminated sewer system. If it is contaminated, it is pumped to a storage tank and either incinerated or transferred to the aqueous organic treatment system in the physical/chemical treatment plant, depending upon the degree of contamination. The liquid level in this sump is monitored and alarms on a high level.

The storage tanks are installed in dyked areas and any drainage held within the dykes. After a rainfall the drainage within the dykes is checked and, if clean, it is discharged to the potentially contaminated sewer by opening a normally closed valve. If it is contaminated it is drained to the pump drainage sump through a normally closed valve.

If there is a large spill into the dyked area, either from a storage tank overflow or a rupture, the contents are held within the dyked area. Most of the contents are pumped to a tank truck or to another storage tank and the area then cleaned to avoid contaminating normal storm drainage.

If there is a fire within the dyked area the discharge valve from the area is opened to permit any firewater or organics to be discharged into the potentially contaminated sewer system.

3.7.5.3 Buildings

In addition to the process areas and general facilities, the following buildings are also provided.

- administration building,
- gatehouse, and
- maintenance building.

Administration Building

The administration building provides accommodation for all on-site staff and contains the main laboratory and data management services. It is a two storey building with a reinforced concrete frame structure, with the exterior facing being concrete panels or insulated preformed metal panels. It is located adjacent to the gatehouse as shown on Figure 3.2.

The main features are:

- All "general" areas, operation facilities and staff personnel located on the ground floor with senior office staff on the upper floor.
- Operating personnel facilities located on the ground floor at the north end of the building to separate them from the general office areas. These facilities include clean and dirty locker rooms/ linen areas, showers and washrooms.
- Main computer hardware rooms are climate controlled.
- Laboratory areas have special venting systems and climate control as necessary.

Gatehouse

The gatehouse provides accommodation and facilities for security personnel controlling the main entrance and exit from the site.

The gatehouse is a single storey building approximately 13 m x 4 m in area, located on an island between the entrance/exit lanes at the main gate of the facility as shown on Figure 3.2. Separate incoming and outgoing weighscales are positioned in the roadway near the gatehouse to enable the security personnel to check and record vehicle weights as well as visually check the condition and cleanliness of the trucks.

Facilities in the gatehouse include:

- communications equipment consisting of a telephone and computer terminal,
- storage for safety equipment such as hard hats and goggles for personnel visiting operating areas, and
- washroom for security staff.

Maintenance Building

The maintenance building provides the necessary space, tools and materials for on-site maintenance of process equipment and plant vehicles.

The maintenance building is a steel framed structure with insulated metal siding approximately 52 m x 25 m x 5.5 m high and includes accommodation for the following:

- Offices for superintendent, and maintenance foremen.
- Technician/draftsperson, buyer, clerk/typist and storekeeper.
- Mechanical, electrical and instrument workshops with facilities for routine maintenance and emergency repairs. The instrument workshops have an area with special climate control for handling delicate instrumentation.
- Stores and spare parts areas.
- Vehicle bay for emergency vehicles, snow clearing equipment and minor plant vehicle maintenance.

3.7.6 DATA MANAGEMENT SYSTEM AND PROCESS CONTROL

This section deals with two subjects directly related to the safety, security, and efficiency of operations at OWMC's Treatment Facility, namely:

- data management system for safe, efficient planning, coordination and management of the overall operations of the Facility, and
- process control system for the control and monitoring of the treatment processes and related safety systems.

3.7.6.1 Data Management System

The Data Management System (DMS) provides an interactive, integrated information/data handling capability for efficient planning, co-ordination and management of the over-all operations of the Facility. These operations encompass the major facets of the Facility and include the following:

- Materials flow - reception, handling and storage.
- Data flow - acquisition, processing and storage.
- Co-ordination and planning of individual processes, operations and administrative functions.
- Updating, maintenance and storage of all required files and records.
- Maintenance of a common integrated data-base to serve all users.
- Generation of reports.
- Historical storage and fast retrieval capability of information/data.

The DMS provides an audit trail for checking that operating, regulatory, and safety procedures are being followed.

The data management system (DMS) is an application oriented, computer based system with all the necessary peripherals and auxiliary equipment. The system hardware and software are selected for flexibility, versatility and modularity to meet the requirements of the Facility along with ease of operation and maintenance. It is based upon proven techniques and technology to offer high reliability and availability at a reasonable cost. Some of the essential characteristics of the DMS include:

- common, integrated data base accessible to all authorized users,

- multi-tasking capability to enable simultaneous usage by a number of users without degradation of service, quality and throughput,

- physical and access security of data within the DMS data-base during input/output, updates, transactions and storage,

- ability to assign, control, prioritize and limit access from any DMS terminal, and

- historical storage and retrieval capability.

The data management system comprises the following main components:

- Common, central DMS equipment and facilities located at the Data Management Centre in the Administration Building.

- Local Data Communications network.

- Data Management System Terminals located at designated areas within the Facility.

The areas designated for terminal access will be determined in accordance with the Facility Operating Procedures. It is anticipated there will be a maximum of twelve terminals.

The main users or functions to be served by the DMS are tabulated below in two broad categories called "Administration" and "Process".

USER/FUNCTION CATEGORY

ADMINISTRATION	PROCESS
Accounting	Gate House
Personnel	Phys/Chem Control Laboratory
Stores/Inventory	Scheduler
Procurement	Incineration Process
Maintenance	Phys/Chem Process
Sales/Marketing	Solidification Process
Analytical Laboratory	Landfill
Sampling Laboratory	Emission/Effluent Monitoring
Management Accounting	Central/Inter-Battery
Suppliers' Data	Utility Usage
Regulatory Data	Operations Management Data
Correspondence Log	
Technical Publications	
Waste Transportation	
Engineering Services	

3.7.6.2 Process Control

The process control provides control and monitoring for the waste treatment process areas, common site services and facilities, and safety systems.

The Process Control System is provided to carry out these functions, and to provide an interface between the process operators and the plant equipment to allow the Facility to operate in accordance with the Operating Plan.

Process control functions for the major processes are carried out from two Control Centres, one located in the Incineration Plant (p. 83) and one in the Physical/Chemical Treatment Plant (p. 122).

The Incinerator Control Centre is the principal Control Centre for the Facility, as it is manned continuously on a 24 hours/day, 7 days/week basis. The Physical/Chemical Control Centre is initially manned 8 hours per day, 5 days per week.

Common process systems, utilities and plant wide safety systems are controlled and monitored from the Incinerator Control Centre.

Other Area Control Rooms and/or Control Panels are situated in areas dictated by operating procedures.

The Process Control System consists of the process control, monitoring and the operator interface equipment required in the two Control Centres, together with the equipment located in the minor operating areas as determined during detailed design.

Limited data storage capability is available in the Process Control System as dictated by the operational requirements of each individual process.

Modern digital technology is employed for the Process Control System. Maximum use is made of operator interface via CRT and digital communication techniques to improve data access and storage and to reduce plant cabling.

Equipment for the Process Control Systems will be selected according to the functions identified and quantified during the detailed design phase of the project. The number of equipment vendors will be kept to a minimum, consistent with functions to be performed and the availability of proven cost-effective equipment.

3.7.7 ELECTRICAL SYSTEMS AND COMMUNICATIONS

This section addresses the distribution of electricity around the site, as well as allied lighting, communications and safety systems, under the following headings:

- main substation and power distribution systems,
- emergency and uninterruptible power supply,
- lighting system,
- grounding system,
- lightning protection system,
- communications,
- hazardous area classification, and
- fire alarm and detection.

3.7.7.1 Main Substation and Power Distribution Systems

The main substation receives the 115 kV supply from Ontario Hydro and transforms it to a lower voltage for use in the plant. This power is then distributed to various load centres throughout the plant by the power distribution system. The systems are designed in accordance with Ontario Hydro Standards and the relevant regulations and codes as detailed in Section 2.8.

Main Substation

The power supply is obtained from a 115 kV power line tapped off Ontario Hydro's 115 kV Q2A circuit, which supplies Dunnville Transformer Station and brought into the main OWMC substation where it is terminated. From this point two 115 kV circuits are connected through their respective high voltage circuit breakers or fused disconnects to the main transformers.

The main substation includes two 115 kV/4.16 kV transformers rated at 5/6.7/7.5 MVA; two 115 kV circuit breakers or fused disconnects; 4.16 kV indoor metal clad switchgear and other auxiliary equipment. The selection of equipment will be finalized during the detailed design phase of the project.

Each main transformer is sized to supply the total plant load on its own. Co-ordinated protective relay schemes are provided to isolate faulty equipment promptly and to allow uninterrupted operation of healthy equipment.

The induced draft fan motor (450 kW) for the incinerator is supplied from 4.16 kV switchgear located within the main substation building.

All outdoor high voltage electrical equipment is located within a security fence and all electrical switchgear and distribution equipment is housed in the substation building. Access to electrical equipment is restricted to authorized personnel only.

Power Distribution System Load Centres

Load Centers (unit substations) 4.16 kV/600 V are installed at key locations throughout the plant to supply power to the process equipment.

Unit substations, each with two transformers, are located in the incineration plant (p. 85) and the physical/chemical treatment plant (p. 125). A substation with a single transformer is installed in the maintenance building.

A secondary selective scheme is employed for the Incinerator and Physical/Chemical substations, consisting of a bus-tie breaker which is normally kept open and automatically closes if one of the 1500 kVA transformers is out of service.

The Unit Substations are fed from the 4.16 kV switchgear, located in the main substation building, through a loop distribution feeder.

All unit substation equipment is installed in electrical rooms located in unclassified areas.

Motor Control Centers

It is estimated that approximately twelve (12) motor control centers are required to supply power to motors and other devices. These motor control centers are strategically located near the load centers in electrical rooms in unclassified areas of the plant.

Voltage Levels

The following voltage levels are used for the process equipment:

Medium Voltage System	4.16 kV, AC, 3 phase, 60 Hz
Low Voltage Systems	600 V, AC, 3 phase, 60 Hz
	120/240 V, AC, 1 phase, 60 Hz
Control Power Supplies	120 V, AC, 1 phase, 60 Hz
	120 V, AC-UPS, 1 phase, 60 Hz
	125 V, DC

3.7.7.2 Emergency and Uninterruptible Power Supply

The emergency power supplies provide alternative power for essential and critical loads during interruption of normal utility supplies.

Essential loads are those loads which can tolerate a short interruption in power supply but which must be restarted within a certain period of time e.g. 30 secs.

Critical loads are those loads which cannot tolerate any interruption in power supply, such as computer systems.

Essential loads are supplied from standby power systems, such as diesel generators, while critical loads are supplied from Uninterruptible Power Systems (UPS).

Emergency and Uninterruptible power supplies are required to:

- run essential processes for a limited time to permit a safe shut down of the plant in the event of utility power supply failure,
- provide continuous power supply for essential lighting and ventilation systems to ensure safety of plant personnel, and

- provide an uninterruptible power supply (UPS) to critical control circuits and monitoring systems of the plant.

Emergency and UPS systems will be finalized during the detailed design phase of the project.

The following combination of systems are provided:

- 125 V DC battery system,
- self contained DC battery pack units,
- DC battery/inverter systems (UPS), and
- diesel engine generators

125V DC Battery

This system consists of DC storage batteries, battery chargers and DC distribution boards.

The DC battery system is located in the Main Substation building and provides control power to switchgear, control circuits, fire alarms, communications and emergency lights (if required). The selection of DC loads will be finalized during the detailed design phase of the project.

Self Contained DC Battery Pack Units

These emergency corridor and exit lighting units consist of maintenance free type batteries and small automatic battery chargers.

The units are installed in hallways, stairwells and exit doors to ensure a safe evacuation of buildings during a power outage and until an emergency power supply from the diesel generators is available. The battery units are rated for a minimum of one (1) hour.

DC Battery/Inverter System/Uninterruptible Power Supply Systems

Uninterruptible Power Supply (UPS) systems provide continuous, disturbance free AC power to critical loads such as computers, sensitive electronic data processing equipment, programmable controllers, communication systems and other control circuits.

A UPS system consists of DC storage batteries, battery chargers, inverter, regulating transformer, and AC distribution boards. This system is capable of operating continuously on line, with no interruption in power when the primary supply source fails.

UPS systems are located in the Incinerator and Physical/Chemical buildings adjacent to centres of critical load.

Diesel Engine Generators

The Diesel Engine Generator package consists of two diesel driven generator sets. Each Diesel Engine Generator set consists of a diesel engine, governor, air intake and exhaust systems, cooling and lubricating system, fuel oil system and other auxiliary devices together with a generator, automatic voltage regulator, generator exciter, cranking battery, automatic synchronizer, control panel and 600V switchgear.

Diesel - generator sets will be selected to meet the emergency load requirement. The generators are sized to provide the full starting kVA and running requirements of the emergency load. The diesel-generators are installed in a non-hazardous area building next to the main substation building (See Figure 3.2).

All essential loads are supplied from the 600V emergency switchgear through their respective emergency MCCs which are strategically located near load centers in the electrical rooms of each process area.

Operation

The following operating philosophy is proposed for the emergency systems.

On loss of utility power all critical loads continue to be supplied, without interruption, from their respective UPS systems.

Both diesel-generator units automatically start and run up to speed. The "lead" unit line circuit-breaker closes as soon as terminal voltage is established, while the "back-up" unit automatically synchronizes with the "lead" unit and runs in parallel. If the "lead" unit line circuit-breaker does not close within a pre-set time limit the control system bypasses the automatic synchronizer and allows the "back-up" unit line circuit-breaker to close.

As soon as voltage is detected at each emergency MCC its automatic transfer switch operates to energize its emergency bus. Emergency loads then automatically restart in a coordinated sequence.

Return of the system to Utility Power is under manual control.

3.7.7.3 Lighting System

The lighting system provides lighting for the safe and efficient operation of the plant. The lighting system provides:

- general indoor and outdoor area lighting,
- working and operating area lighting,
- emergency exit lighting for evacuation during power blackouts, and
- emergency operational lighting during power blackouts of long duration.

The lighting system consists of:

- Indoor lighting which includes process, production, workshop and office areas.

- Control room lighting.

- Outdoor lighting which includes outdoor process areas, parking areas, roads, periphery fence, landfill sites and other surrounding areas as required.

- Emergency lighting which includes lighting for safe shutdown and monitoring of essential equipment.

- Emergency exit lighting within all buildings and enclosed areas.

- Stack lighting.

Emergency lighting is supplied from the Emergency Diesel Generators.

Emergency exit lighting is supplied from self contained, auto switched battery packs strategically located for safe evacuation during emergencies.

In outdoor areas and production areas, metal halide (MH) fixtures are used.

For office areas, laboratories, locker facilities and other ancillary buildings, fluorescent lights are used.

Where necessary, lighting fixture material is suitable for chemical environments.

Outdoor lighting fixtures are chosen so as to direct all illumination onto the designated areas.

Stack lighting is in accordance with Ministry of Transportation and Communications requirements.

3.7.7.4 Grounding System

The plant grounding system provides a physical interconnection of the plant power distribution system and associated electrical equipment to a common ground.

The grounding system provides the following protection:

- Limits overvoltages and potential gradients in the plant.

- Provides for isolation of faulty equipment and circuits if a fault occurs.

- Ensures the safety of personnel and the protection of equipment.

A ground grid is provided whose resistance is kept as low as possible to ensure that the rise in ground potential is minimized during ground faults.

Generally bare copper conductors and steel ground rods are used for the ground-grid system. Grounding conductors in potentially corrosive areas are PVC covered and connections coated with epoxy paint and taped to ensure that no copper is left exposed. Stainless steel ground rods are installed in these areas.

Compression or thermoweld type connections are used throughout the grounding installation. Connections to permanent fixtures such as building steel are generally of thermoweld type whereas ground conductors are bolted to removable equipment such as motors, etc. Special consideration is given to connections of metallic structures treated with anti-corrosive paints to obtain a good electrical contact.

Communication circuits, metallic pipes and rails (if any) entering the Facility are isolated at the site boundary to prevent transfer of ground potentials outside the Facility. Isolation of these systems is designed in close co-operation with the various utilities servicing the Facility.

3.7.7.5 Lightning Protection System

The lightning protection system safeguards personnel, buildings and equipment from the hazards arising from exposure to lightning.

The lightning protection system consists of a series of air terminals, conductors, and grounding connections which provide an alternative path to ground for lightning strikes. This low impedance path effectively bypasses buildings and structures thereby protecting them from the very high currents and potential gradients involved.

The design of the system varies for each building or structure and depends on such factors as:

- type of structure,
- type of construction,
- height,
- roof geometry,
- proximity to other structures,
- ground resistance, and
- calculated risk factor.

The evaluation and design of this system will be finalized during the detailed design.

3.7.7.6 Communications

The plant communications system provides facilities for all communications necessary for safe and efficient operation of the plant.

Communications are required for:

- broadcasting general announcements to all personnel in the plant,
- broadcasting warning signals or instructions to all personnel in the plant,
- direct connections with police, hospitals, ambulances and fire department during emergencies,
- paging key personnel in various areas of the plant,
- telephone calls to conduct normal day-to-day business of the plant, and
- supplementary communication system such as beepers and walkie-talkies.

The communications systems comprise varying degrees of usage of the following:

- telephone systems,
- public address systems,
- personal paging systems (beepers), and
- multi channel walkie-talkies.

Telephone System

A complete plant telephone system is proposed, consisting of a Private Automatic Exchange (50 extensions), including Main Distribution Frame, all necessary line circuits, protective devices, terminal boxes, an attendant's or operator's console for the reception and re-routing of incoming calls and, where necessary, the placing of outgoing calls.

In addition to the above, the system is also equipped with a smaller console, with limited facilities, for use by a night operator. This smaller console is located in the continuously occupied incinerator control room.

The telephone system is completely separate from all other communication systems.

Dedicated telephone lines for monitoring fire alarms in local municipal fire-alarm head quarters can also be provided.

All components of the system are solid state design using digital technology.

Public Address System

The Plant Public Address System incorporates the following features:

- paging of people in various areas of the plant,
- making overall general announcements, and
- broadcasting general warning signals to all people in the plant.

The system provides for all paging calls or announcements to be initiated by the telephone operator. As stated earlier, the night-switch turns control of the telephone system to the incinerator control room.

The system is segregated into several discrete areas, e.g. (Phys/ Chem Building, Incinerator Building, Gatehouse, Offices etc.) so that a paging call can be limited to one or more specific areas in which the paged person may be located.

In addition, a master switch is provided to simultaneously link discrete area systems in order to permit plant-wide paging or announcements.

An audible alarm system is incorporated whereby different types of sounds are electronically produced to indicate an emergency or other prevailing type of condition (e.g. fire, accident etc.).

Speakers are strategically located throughout the plant. Where necessary, easily accessible volume adjusting switches are provided in order to permit optimization of the system effectiveness.

Speakers are specified for the environment in which they are to be installed.

Supplementary Communications

The supplementary communication system comprises the following types of equipment:

- beepers, and
- multi-channel walkie-talkies.

Beepers are provided for use by key personnel whose duties do not confine them to any specific area of the plant and thus they may not be easily paged over the PA system or may not reply to a paging call.

As an aid to maintenance personnel and to operators whose duties take them to remote areas, e.g. tank farm, etc., multi-channel walkie-talkie equipment is provided.

3.7.7.7 Hazardous Area Classification

A brief description of the various areas together with their hazardous classifications is presented in Table 3.1.

3.7.7.8 Fire Alarm and Detection

The fire alarm and detection system ensures the safety of personnel by continuously monitoring equipment, plant and buildings for any sign of fire and providing early warnings of trouble.

Fire protection and extinguishing systems are covered in Section 3.7.8 of this report.

The fire alarm and detection system consists of a centrally located monitoring station together with detection devices strategically located throughout the Facility.

The detection devices include ionization, photo-electric, thermal, infra-red and ultraviolet detectors as appropriate together with manual pull stations and equipment inputs such as hydrant water pressure, sprinkler systems, automatic doors and ventilation systems.

The central station continuously monitors each device and verifies that all devices are operating within preset limits.

The system is capable of advising alarm and trouble status, fire locations, recommended actions and initiating direct communications with the fire department.

The fire alarm and detection system will be finalized during the detailed design phase of the project.

TABLE 3.1

HAZARD AREA CLASSIFICATION

AREA	CLASSIFICATION
Administration Building	Class I Division 1 - top of sampling platform adjacent to Administration Building
	Class I Division 2 - area surrounding sampling platform, laboratory and sample storage area within the Administration Building
	Unclassified - remainder of Administration Building
Maintenance Building, Gatehouse and Weighscales	Unclassified
Solidification Plant, Solidified Material Interim Storage Building, Solidified Material Conveyor and Truck Load Out Station	Class II Division 2
Physical/Chemical Treatment Plant	Class I Division 1 - area surrounding agitators associated with organic treatment systems

TABLE 3.1

HAZARD AREA CLASSIFICATION (Cont'd)

AREA	CLASSIFICATION
	Class I Division 2 - remainder of area associated with organic treatment systems
	Unclassified - remainder of building
Physical Chemical Storage Tank Area	Class I Division 2
Inorganic and Organic Drum Storage and Handling Buildings, Segregated Organic Storage Tank Area and Storage Building	Class I Division 1
Inorganic and Organic Tank Truck Unloading Areas	Class I Division 1 - below grade
	Class I Division 2 - above grade
Incineration Plant	Class I Division 1 - areas around waste bunkers, feed deck, front wall of rotary kiln and secondary combustion chamber
	Unclassified - remainder of building
Incinerator Tank Farm	Class I Division 2

TABLE 3.1

HAZARD AREA CLASSIFICATION (Cont'd)

AREA	CLASSIFICATION
Incinerator Waste Receiving Tanks	Class I Division 2
Emergency Power Station and Main Substation	Unclassified
Surface Water Pumphouse	Unclassified
Sanitary Sewage Plant	Unclassified
Raw Water Treatment Plant	Unclassified
Firewater Pumphouse	Unclassified
Ponds	Unclassified
Drum Conveyor	Class I Division 1
Incinerator, Auxiliary Boiler and Evaporator Stacks	Unclassified
Pipe Rack	Unclassified
Truck Holding and Parking Areas	Unclassified
Meterological Air Monitoring Station	Unclassified

TABLE 3.1

HAZARD AREA CLASSIFICATION (Cont'd)

AREA	CLASSIFICATION
Truck Wash Station	Class I Division 1
Evaporator/Recycle Pumphouse	Unclassified
Fuel Oil Tanks	Class I Division 2
Effluent Storage Tanks	Unclassified

3.7.8 FIRE PROTECTION

The fire protection systems ensure that the Facility is equipped with the capability to minimize the consequences of fire.

The proposed fire protection system incorporates a high level of fixed protection utilizing various fire fighting agents. The major fire fighting agent for the Facility is water, which is used not only in direct application to fires but also as the major constituent of foam for the foam system.

The fire water system consists of a fire pond, with a total storage volume of 7575 m^3 exclusive of ice cover and divided into two equal sized sections, which stores water and feeds the fire pumphouse. The volume of each compartment will support fire fighting for a duration of 4 hours. The pumphouse contains multiple fire pumps which supply an underground fire main which is looped around the central operating area so that water can be supplied to any specific location from two directions. The multiple fire pumps comprise three units, each sized to supply 158 L/s. Two of the units are diesel engine driven and the third unit is electric motor driven. Any two of these units are capable of supplying the maximum anticipated fire flow of 220.5 L/s (3500 US gpm). A small jockey pump is provided to maintain the pressure in the firemains system.

The buried loop main is valved to allow maintenance work to be performed without interrupting the fire protection to any specific location.

The loop main supplies fire hydrants to enable outdoor fire fighting using hoses connected to the hydrants and also supplies fixed fire protection systems located within facility buildings. These fixed systems include standpipes and hose cabinets, sprinkler systems and deluge systems.

Fire hydrants and monitors are sized for flows of 63 L/s and 31.5 L/s respectively.

Additionally, the loop main supplies water to the foam system which proportions the required amount of foam concentrate, adds the concentrate to the fire water and discharge fire fighting foam liquid, via a separate foam main, to the foam fire fighting systems. The detail design phase of the project will determine whether a central foam system, or a number of local foam systems are to be installed within the Facility.

"Halon" gas fire protection is utilized in process control rooms and in the instrument rooms of the laboratories. The control rooms are equipped with central "Halon" systems consisting of "Halon" charged gas cylinders supplying fixed discharge nozzles through a permanently installed distribution piping system. The laboratory instrument rooms are equipped with portable, wall mounted "Halon" gas extinguishers.

Portable fire extinguishers are also located throughout the Facility.

All fire protection systems are controlled by fire detectors, of a type appropriate to the application, which automatically initiate the operation of the specific system and alarms the occurrence. Continuous automatic monitoring of all systems is also provided.

Table 3.2 provides a summary of the various types of fire protection provided in different areas of the Facility.

The following passive fire protection features have been incorporated into the overall facility design. Such features underline the consideration which has been given to ensuring that OWMC's Treatment Facility is designed to the highest standards with regard to the minimization of risk to human health, the environment and cost resulting from fire.

- Appropriate distances between process areas within the Central Operating Area, to ensure adequate separation between high hazard areas and locations where people are concentrated (eg. between the Administration Building and the Incinerator Tank Farm).

TABLE 3.2
FIRE PROTECTION SYSTEM EQUIPMENT

AREA	FIRE PROTECTION SYSTEM
Administration Building	External hydrants, sprinklers, standpipe and hose cabinets, fixed Halon in Computer Room, portable Halon in Instrument Laboratory, standpipe and hose cabinets in balance of Laboratory.
Maintenance Building	External hydrants, sprinklers
Gatehouse & Weigh Scales	External hydrants
Solidification Plant	External hydrants, standpipe & hose cabinets
Physical/Chemical Treatment Plant	External hydrants, sprinklers, Halon in control room, portable Halon in Instrument Laboratory, standpipe and hose cabinets in balance of Laboratory
Physical/Chemical Storage Tank Area	External hydrants, sprinklers, foam deluge for organic storage area
Inorganic Drum Storage and Handling Building	External hydrants, sprinklers, portable Halon for Control Room
Inorganic Tank Truck Unloading Area	External hydrants, water deluge
Incineration Plant	External hydrants, standpipe & hose cabinets, water deluge for bunkers and kiln feed chutes, Halon for Control Centre
Organic Drum Storage and Handling Building	External hydrants, foam sprinklers,portable Halon for Control Room
Incinerator Tank Farm	External monitor hydrants

TABLE 3.2
FIRE PROTECTION SYSTEM EQUIPMENT (Cont'd)

AREA	FIRE PROTECTION SYSTEM
Organic Tank Truck Unloading Area	External hydrants, foam deluge
Incinerator Waste Receiving Tanks	External monitor hydrants, foam
Segregated Organic Storage Tank Area	External hydrants, foam deluge water spray
Storage Building	External hydrants, foam injected sprinklers water sprinklers in foam house
Main Substation	Firewalls separating Main Transformers from each other and from Emergency Power Station
Emergency Power Station	External hydrants
Surface Water Pumphouse	External hydrants
Sanitary Sewage Plant	External hydrants
Raw Water Treatment Plant	External hydrants, standpipe and hose cabinets
Firewater Pumphouse	External hydrants, sprinklers
Solidified Material Interim Storage Building	External hydrants
Solidified Material Conveyor	External hydrants
Drum Conveyor	Foam deluge

TABLE 3.2
FIRE PROTECTION SYSTEM EQUIPMENT (Cont'd)

AREA	FIRE PROTECTION SYSTEM
Pipe Rack	External hydrants and monitors
Temporary Truck Holding Area (organic)	External hydrants
Truck Holding Area (organic)	External hydrants
Temporary Truck Holding Area (inorganic)	External hydrants
Truck Holding Area (inorganic)	External hydrants
Car Park	External hydrants
Truck Load Out Station	External hydrants
Truck Wash Station	External hydrants, sprinklers
Evaporator/Recycle Pump House	External hydrants
Fuel Oil Tanks	External monitor hydrants plus foam
Effluent Storage Tanks	External hydrants

Note: In addition to the above, the numbers, types and locations of portable fire extinguishers will be determined during the detailed design phase of the project.

- Adequate spacing between process areas to prevent a possible domino effect leading to increased loss and to prevent major damage to adjacent units from hazards such as fire and explosions.

- Adequate access for fire fighting purposes with at least two access routes from different directions.

- The use of appropriate materials and types of construction for buildings and structures within the Facility to provide the necessary fire resistance ratings specific to the application.

- The provisions of fire separation walls between adjacent areas within areas to ensure appropriate protection to each area.

- The utilization of explosion venting panels in building construction, where required.

- The design of electrical distribution systems to the appropriate classifications for the service.

- The design of appropriate ventilation and inert gas blanketting systems to reduce hazard potential.

3.7.9 VENT EMISSION CONTROL AND NITROGEN BLANKETTING SYSTEM

The vent emission control system minimizes the release of contaminants to the environment due to the release of vent gas and exhaust air from process equipment and process building areas of the Facility. The vent systems for organic storage and treatment are combined with nitrogen blanketting.

The vent emission control systems comprise two general types of systems as follows:

- organic emission control, and
- inorganic emission control.

3.7.9.1 Organic Emission Control

Organic emission control are effected either by piping the vent gases to the rotary kiln incinerator (p. 62) for destruction of organic contaminants or by piping the ventilation air through activated carbon adsorbers for the removal of organic contaminants prior to the discharge of air to atmosphere.

Vent gases are piped to the rotary kiln incinerator, via a flame arrester, from the following equipment:

- incinerator waste receiving tanks at the organic tank truck unloading area (p. 38),
- organic waste storage tanks at the incinerator tank farm (p. 177),
- organic waste blending tanks at the incinerator tank farm (p. 177),
- organic waste vacuum tanks at the organic drum storage and handling building (p. 189), and
- aqueous organic waste storage tanks at the physical/chemical storage tank area (p. 181).

These tanks are all under a nitrogen blanket, to minimize fire and explosion hazards, with the nitrogen pressure controlled automatically between 14 and 70 kPa. Volumetric changes in these tanks due to pump-in or pump-out of waste, or due to temperature fluctuations, are balanced within the tank groups and normally result in pressure fluctuations within the established range stated above. The release of vent gas (nitrogen) from the tank groups to the incinerator only occurs due to large increases in the volume of waste in the tank group.

In the case of the organic waste vacuum tanks, the exhaust from the vacuum pumps discharges to the incinerator continuously while drums are being processed in the organic drum storage and handling building.

Dual activated carbon adsorbers are provided to handle the vent gases from these systems during times when the incineration plant is out of operation. The dual system permits continued operation while activated carbon media is being replaced in one unit.

The nominal removal efficiency for activated carbon adsorbers is 90%.

Vents from the segregated organic storage tanks in the incinerator tank farm are handled in an identical manner to that described above, normally venting to the incinerator. The vents from these tanks are kept separate from others, however, because of the particularly toxic nature of wastes which may be stored in these tanks and the desirability of isolating these materials to the maximum extent possible.

Ventilation air from the drum sampling and process area of the organic drum storage and handling building (p. 196) are exhausted through dual activated carbon adsorbers for the removal of organic contaminants prior to discharge of this air to atmosphere.

The two inground organic waste unloading tanks at the organic tank truck unloading area are equipped with three separate vent systems to effectively control fugitive emissions and ensure operator safety. The first system consists of high volume ventilation from the canopy over the unloading tanks to minimize the escape of fugitive emissions during unloading. The ventilation system exhausts air through dual activated carbon adsorbers prior to discharge to atmosphere. It is operated when wastes are being unloaded. The second system involves a much lower rate of ventilation and provides a continuous ventilation of the unloading tank. The unloading tank is kept under negative pressure to prevent the escape of fugitive emissions during standby operations. This system also includes dual activated carbon adsorbers for contaminant removal. The third system provides ventilation to the below grade basin which contains the unloading tank, and is provided to avoid the accumulation of vapours which could cause an explosion or be injurious to operator health. The vent from this basin is normally discharged directly to atmosphere since organic contamination is expected to be minimal.

3.7.9.2 Inorganic Emission Control

Inorganic emission control systems minimize fugitive emissions associated with inorganic waste storage, handling and processing equipment. While the contaminants in the vent gases are predominantly inorganic, it is likely that some organic constituents may also exist and for this reason, all inorganic emission control systems include wet scrubbing for the removal of inorganic contaminants followed by an activated carbon adsorber for the removal of trace organics.

The removal efficiency of wet scrubbers is expected to be better than 90% under all normal operating conditions.

The following process equipment in the physical/chemical treatment plant are connected to a two-stage emission control system comprising a multi-stage scrubber with reagent addition followed by dual activated carbon adsorbers for the removal of contaminants prior to the discharge of ventilation air to atmosphere:

- acidic and neutral/alkaline waste storage tanks at the physical/chemical storage tank area (p. 177),

- sodium hydrosulphide reagent storage tank in the reagent storage and feeding system (p. 120),

- reactors in the inorganic waste treatment system (pp 107, 108), and

- emulsion breaking tanks and dissolved air floatation units in the aqueous organic waste treatment system (pp 115, 116).

The ventilation air from the drum sampling and active process area of the inorganic drum storage and handling building (p. 194) is routed to a two-stage emission control comprised of a water scrubber and dual activated carbon adsorbers. The system removes contaminants prior to the discharge of ventilation air to atmosphere.

A single vent emission control system is provided for the organic and inorganic sides of the truck wash station (p. 242). The air from exhaust hoods and truck tanks is combined with the vent gas from wash liquid tanks, and vented to atmosphere through a two stage emission control system comprising a water scrubber followed by a dual activated carbon filter.

The inground inorganic waste unloading tanks (p. 39) are equipped with three separate vent systems to effectively control fugitive emissions and ensure operator safety, similar in concept to the system previously described for the inground organic waste unloading tanks (p.239). The system comprises a high volume ventilation system for the containment of emissions during unloading, a low volume system for the containment of emissions during pumpout and/or standby conditions, and a third ventilation system to prevent the accumulation of hazardous vapours in the below grade basin which houses the unloading tanks. The first two systems have separate two-stage emission controls comprising water scrubbers and dual activated carbon adsorbers arranged in series. Ventilation systems can be segregated to provide separate collection and vent gas scrubbing for unloading tanks dealing with neutral/alkaline wastes.

3.7.9.3 Operation

The main operating considerations of the vent emission control systems are:

- Regular monitoring of system performance will be performed to ensure that systems are working efficiently, to make required adjustments to scrubber circulatory liquor quality, to monitor carbon adsorber temperatures and to schedule replacement of activated carbon media.

- Replacement of activated carbon media will be pre-scheduled and either incinerated on-site or sent to an approved facility for regeneration.

- Liquid effluent from the vent scrubbers will be held in storage tanks and processed in the physical/chemical treatment plant.

3.7.10 TRUCK WASH

The truck wash station provides facilities for washing bulk waste tanker vehicles subsequent to their unloading and prior to their departure from the Facility.

Figure 3.34 illustrates the conceptual design of the truck wash at the Facility. Two similar systems are provided, one for tankers which have carried organic waste, and the other for tankers which have carried inorganic waste.

Separate wash systems are provided to maintain separation of organic and inorganic waste residuals.

Each wash system is identical and consists of a below-ground holding tank (of 20 m^3 capacity), a circulating pump, a set of rotary tank wash nozzles and associated instrumentation and vent systems.

Caustic soda is added to the washing solution in order to maintain a pH of about 10 to 11 in the inorganic system and to react with the residual organics in the organic system.

The below ground holding tanks are emptied by pumping their contents to the physical/chemical storage tank area for treatment in the physical/chemical treatment plant when either of the following conditions occur:

- the holding tanks become full, or
- the concentration of contaminants is such that the effectiveness of washing is impaired.

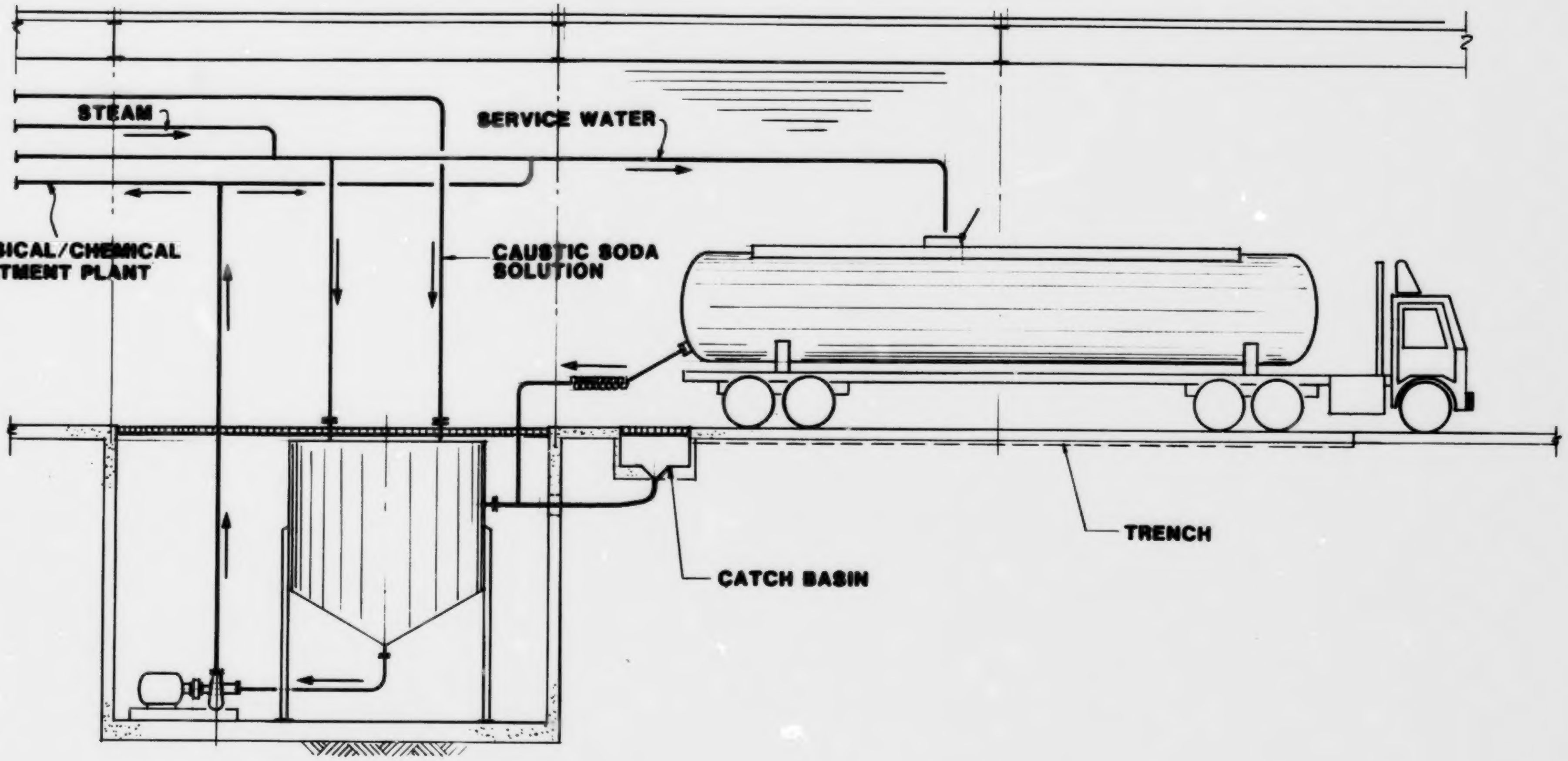

STEAM
SERVICE WATER
TO PHYSICAL/CHEMICAL TREATMENT PLANT
CAUSTIC SODA SOLUTION
TRENCH
CATCH BASIN

FIGURE 3.34
TANK TRUCK
WASHING FACILITY
PICTORIAL SCHEMATIC

3.7.11 LABORATORIES

The on-site laboratory facilities determine the characteristics of the wastes proposed for treatment and define guidelines for their shipment, receiving, sampling, unloading, storage and treatment at the Facility. The laboratory facilities also conduct tests to ensure that treatment objectives are being achieved. A further purpose is to recommend and implement an environmental monitoring program and provide technical services to the waste reduction program and client development.

The laboratories are required to carry out a wide range of functions in distinct stages as identified below and further illustrated in Table 3.3, namely:

- pre-shipment authorization stage,
- delivery stage,
- treatment stage,
- post treatment stage, and
- waste reduction.

Two alternative laboratory facilities have been considered, i.e. centralized versus dispersed laboratory facilities. A centralized laboratory involves a fully equipped main laboratory in the administration building and a satellite laboratory in the physical/chemical treatment plant to carry out non-sophisticated routine tests. For the dispersed laboratories, the laboratory facilities are segregated into two distinct, fully-equipped laboratories, i.e. a main laboratory in the administration building and a physical/chemical laboratory in the treatment plant. An in-depth assessment of these two alternatives will be undertaken during detailed design.

This section describes the laboratory facilities based on the dispersed laboratories concept.

3.7.11.1 Main Laboratory

The main laboratory and its staff carry out functions which include:

TABLE 3.3

LABORATORY FUNCTIONS AT STAGES OF WASTE TREATMENT

PRE-SHIPMENT AUTHORIZATION	DELIVERY	TREATMENT	POST TREATMENT	FUNCTIONS IN WASTE REDUCTION PROGRAM
• analyze and characterize samples of waste for various parameters.	• sample and analyze waste consignments to verify characteristics ("fingerprinting").	• conduct process control analyses for performance verification and monitoring.	• environmental monitoring, sampling and analysis.	• analyze and characterize samples of waste for various parameters
• treatability test samples of waste to recommend treatment processes, procedures, reagents and other process parameters.	• conduct additional analytical or treatability tests as required.	• monitor working environment.	• input to reports to regulatory agencies.	• bench scale tests for potential processes for waste reduction and assist evaluation of the processes.
• recommend occupational health and safety measures.	• identify requirements for cleaning equipment and piping.	• update or modify treatment recommendations for future reference, if required.		
• establish guidelines for "fingerprinting" of waste upon delivery.	• confirm treatment procedures.			
	• assign unloading and storage location in conjunction with Operations.			

- the analysis and characterization of all inorganic and organic waste prior to its acceptance by OWMC,

- verification that the wastes received for treatment are the same as those previously submitted as samples for analysis, excepting drummed inorganic waste which may be analysed in the physical/chemical laboratory for reasons of efficiency arising from physical location,

- recommendation of worker safety procedures for sampling, testing, unloading and handling the wastes,

- providing analytical services to environmental monitoring program,

- providing analytical services to monitor the worksite environment as part of an occupational health program,

- providing input to reports for submission to regulatory authorities,

- providing technical services to operations personnel in the daily operation of the plant, including support to incineration plant operations,

- providing technical services to OWMC's Marketing Department such as analytical tests and development work related to waste reduction program, and

- establishing quality control procedures for all analytical work.

The main laboratory comprises four sections as follows:

- sample receiving section,
- characterization section,
- instrument section, and
- environmental monitoring section.

The laboratory also includes office space for the laboratory staff, for marketing and technical services and facilities for chemical supplies storage.

Table 3.4 identifies major equipment proposed for each section of the main laboratory.

The reasons for separating the sections in the main laboratory are as follows:

- The sample types range from very dirty, toxic and odorous (waste samples) to clean air quality samples. Separation lessens the likelihood of contamination of cleaner samples.

- Some of the instrumentation is very sophisticated and costly electronic equipment that requires specialized care and controlled conditions in order to achieve proper performance. This equipment is located in an air conditioned room under positive pressure to eliminate the effects of corrosive and undesirable fumes.

Sample Receiving Section

This section has the responsibility to sample waste upon delivery to the Facility and prepare these samples for characterization or "fingerprinting". All sample documentation is performed by this section which works closely with the characterization and instrument sections of the main laboratory.

Characterization Section

The responsibilities of this section are to characterize the organic and inorganic waste for treatment purposes, mostly prior to its delivery. It works together with the main laboratory instrument section to analyse the sample for certain critical parameters such as heating value, density, solids content, cyanide, sulphur and chlorine content. If required, it then transfers the waste sample to the physical/chemical laboratory where treatability and leachability tests are carried out. It recommends "fingerprinting" measurements to verify that the material

TABLE 3.4
MAIN LABORATORY - MAJOR EQUIPMENT AND INSTRUMENTATION

TYPES OF INSTRUMENTS DESCRIPTION	PARAMETER MEASURED/PURPOSE CONCENTRATION LEVEL	CHARACTERIZATION SECTION	INSTRUMENT SECTION	ENVIRONMENTAL SECTION
Gas Chromatograph				
- Flame ionization detector	Organic quantification ppm range	*	* (Coupled with mass spectrometer)	--
- Electron capture detector		--		*
- Thermal conductivity detector		*	--	--
Mass Spectrometer	Organic identification and quantification/ppm range	--	*	--
Inductively Coupled Plasma Emission Spectrometer (ICP-ES)	Trace metals in aqueous solution/ppb range	--	*	--
Atomic Absorption Spectrophotometer	Trace metals in aqueous solution/ppm-ppb range	--	*	--
Calorimeter	Heating value	*	--	--
Total Organic Carbon Analyser	Organic carbon content of water/ppm range	--	--	*
Ion Chromatograph	Trace levels of anions in aqueous solution/ppm	--	--	*
High Temperature Analyser	Total carbon, hydrogen, nitrogen and sulfur content/ppm	*	--	--

TABLE 3.4
MAIN LABORATORY - MAJOR EQUIPMENT AND INSTRUMENTATION (Cont'd)

DESCRIPTION	PARAMETER MEASURED/PURPOSE CONCENTRATION LEVEL	TYPES OF INSTRUMENTS		
		CHARACTERIZATION SECTION	INSTRUMENT SECTION	ENVIRONMENTAL SECTION
Infrared Spectrophotometer	Organics identification and fingerprinting, oil/grease contents/ppm range	*	--	--
Long path length ultraviolet (UV) Spectrophotometer	Mercury in effluents/ppm range	--	--	*
Ultraviolet (UV)/Visible Spectrophotometer	For determination of certain anions and fingerprinting purposes/ppm range	*	--	--
pH Meter	pH in aqueous solution	*	--	--
Flash Point Apparatus	Flash point	*	--	--
Viscometer (Brookfield)	Viscosity	*	--	--
Noise Level Monitor	In plant noise levels	--	--	*
Air Sampling Pumps	Sampling of dust and organic vapours	--	--	*
Fume Hood Standard Bench Top	--	*	*	*
Centrifuge	Phase separations	*	--	--

NOTE: * Denotes location of equipment/instrumentation in the relevant section delivered at a later date for treatment, is similar to the one characterized earlier within prescribed limits.

Instructions are provided for unloading and storage of each waste consignment including specific unloading stations and storage tanks, which will be determined in conjunction with Operations. Requirements for cleaning equipment after use, are also given.

This section will also provide analytical services and carry out development work related to waste reduction program, working together with other sections of the laboratories. Space will be allocated for specialized equipment for bench scale test or pilot study.

Instrument Section

The analytical instrumentation located in this section is primarily the specialized equipment that requires highly trained personnel for correct operation, data interpretation and instrument maintenance. The quantity of sample and site fugitive emissions entering the room are minimized by operating procedures and by appropriately designed ventilation systems.

Environmental Monitoring Section

This section has the responsibility to ensure that the workplace and the surrounding environments are properly monitored. It is concerned with the measurement of low levels of inorganic and organic contaminants in the environment. This section is separate from the others in order to avoid contamination of samples and it works closely with the instrument section for certain analyses. Trace elements in dust and identification and quantification of organic compounds in final treatment effluents are some analyses that may be done. Noise and safety procedures in the work place are also the responsibility of this section.

3.7.11.2 Physical/Chemical Laboratory

The physical/chemical laboratory is located in the physical/chemical treatment plant (p. 123). The laboratory comprises three sections as follows:

- process control section,
- instrument section, and
- solidification section.

Table 3.5 identifies major equipment proposed for each section of the physical/chemical laboratory.

The reasons for separating sections in the physical/chemical laboratory are similar to those previously identified for the main laboratory.

- The sample types range from very dirty, toxic and odorous to relatively clean leached water samples. In addition, the solidification laboratory has a tendency to be dusty. Separation of the three sections avoids transport of these contaminants.

- The instrument section houses very sophisticated and costly electronic equipment that requires specialized care and controlled and clean air conditions in order to achieve proper performance. This section is air conditioned and under positive air pressure to eliminate the effects of dust and corrosive fumes.

The physical/chemical laboratory and its staff carry out functions which include:

- treatability tests on inorganic wastes to determine optimum treatment sequences, procedures, reagent needs and other process parameters, and determination/definition of "fingerprint" test,

- verification testing (fingerprinting) of inorganic waste delivered in drums, if required,

- process control analyses, to confirm that the treatment is proceeding as expected,

TABLE 3.5
PHYSICAL/CHEMICAL LABORATORY - MAJOR EQUIPMENT AND INSTRUMENTATION

TYPES OF INSTRUMENTS DESCRIPTION	PARAMETER MEASURED/PURPOSE CONCENTRATION LEVEL	PROCESS CONTROL SECTION	SOLIDIFICATION SECTION	INSTRUMENTATION SECTION
Inductively Coupled Plasma Emission Spectrometer	Trace metals in solution/ppm-ppb range	--	--	*
Total Organic Carbon Analyser	Organic carbon content of water/ppm range	*	--	--
Ion Chromatograph	Trace levels of anions in aqueous solutions/ppm	--	--	*
Infrared Spectrophotometer	Oil/grease contents of aqueous solutions	*	--	--
Long Path Length Ultraviolet (UV) Spectrophotometer	Mercury in process effluents/ppm range	*	--	--
pH Meter	pH in aqueous solutions	*	*	--
Walk-in Fume Hood - Standard Bench Top	--	*	*	--
Unconfined Compressive Strength Tester	For testing strength of solidified waste - test mould	--	*	--
Triaxial Cell and Accompanying Gauges	For testing permeability of solidified waste test mould	--	*	--

NOTE: * Denotes location of equipment/instrumentation in the relevant section

- establishing optimum solidification formulations for the solidification process, and

- conducting physical and chemical (leachability) tests on samples of solidified material for quality control purposes.

Process Control Section

The responsibilities of this section are as follows:

- Bench scale treatability tests on inorganic waste received at the pre-shipment authorization stage. It will recommend treatment sequences, procedures, reagent requirements and other process requirements necessary for each inorganic waste type. Tests such as jar testing of coagulant acids and bench scale reverse osmosis testing will be conducted here.

- Wet chemical tests necessary for process control. Support from the physical/chemical instrumentation section will be required for certain instrumental analysis such as ICP-ES (inductively coupled plasma emission spectrometer) and ion chromatography. The results will also become the basis for refining the treatment procedures or recipes in the data base.

- Verification testing on inorganic wastes delivered to the site in drum containers.

- Assist calibration and maintenance of on-line process control measuring devices.

Instrumentation Section

This section is equipped with specialized instrumentation to measure trace and major levels of cations and anions in solution. It provides support to the process control section and solidification section. The quantity of sample and site fugitive emissions entering the room is minimized by operating procedures and the design of ventilation systems.

Solidification Section

The responsibility of this section is to optimize solidification formulations and to test samples of solidified materials for quality control purposes.

Tests include physical testing of "test moulds" for parameters such as unconfined compressive strength and permeability in addition to chemical tests of the "test moulds" for its leachability characteristics. Leachates from these tests will be submitted to other physical/chemical laboratory sections for determination of major and trace levels of cations and anions. Trace organic levels in the leachates will be determined by the main laboratory - instrumentation section.

3.7.12 SAFETY AND SECURITY

The safety and security systems minimize risk to human health, the environment, and Ontario's investment from accidents on site and potentially undesirable consequences of unauthorized access to the Facility.

Various features incorporated into the conceptual design of the Facility include:

- engineered containment systems designed to minimize the release of contaminants to groundwater systems,
- fire protection features,
- ventilation systems designed to minimize the release of fugitive emissions to the atmosphere,
- safety showers, eye baths and breathing apparatus, and
- plant security.

3.7.12.1 Engineered Containment

The engineered containment systems mimimize to the extent practical, opportunities for the release of contaminants from the central operating area to groundwater systems as further addressed in Section 4.2.4 (p. 272).

3.7.12.2 Fire Protection

The fire protection systems ensure that the Facility is equipped with the necessary capaability to minimize the consequences of fire as addressed in Section 3.7.8 (p. 232).

3.7.12.3 Ventilation Systems

The ventilation systems minimize the release of fugitive emissions as addressed in Section 3.7.9 (p. 237) and provide a suitable environment for equipment and operators within the Facility.

3.7.12.4 Safety Showers, Eye Baths and Breathing Apparatus

These features provide emergency relief to personnel who may have come into contact with hazardous chemicals or been exposed to hazardous fumes as a result of an accidental spill or leakage within the Facility.

Combination safety shower and eye bath units are provided through out the Facility at locations where the handling of hazardous chemicals is anticipated. In addition to fixed safety shower and eye bath stations, appropriate areas of the Facility are equipped with a suitable number of portable units providing eye-wash and face and body spray capability.

Portable respirators are located throughout the Facility where there is the potential for release of hazardous gases from abnormal operation or upset condition.

3.7.12.5 Plant Security

A conventional level of security is provided at OWMC's Facility including perimeter fencing, controlled access to the Facility and restricted access to control rooms and critical documentation systems.

The initial barrier to unauthorized entry to the Facility is a 3 metre high chain link fence, with extension arms carrying three strands of barbed wire, surrounding the entire perimeter of the site. Three openings are provided in this fence: one for the main plant access road, which has a gatehouse and security staff present 24 h/day; one for the emergency access road which is unmanned with a locked gate; and one for the landfill access road, which is manned by security staff during operating hours outside of which it is closed with a locked gate.

Entry to the central operating area, which is separately fenced includes two main control points, those being the main gate for vehicular traffic cleared for entry (p. 30) and the administration building for pedestrian traffic including staff and visitors.

All visitors, materials and vehicles authorized to enter will be checked in and out. Visitors will be required to display identification, wear appropriate safety clothing where required, and be accompanied by an OWMC employee. Check-in and check-out procedures for all visitors and employees will be enforced for both security reasons and safety purposes.

Access to the plant areas, control rooms and critical documentation systems is restricted to authorized personnel only.

CHAPTER 4

ENVIRONMENTAL CONSIDERATIONS

4.1 INTRODUCTION

Section 1 (c) of the Environmental Assesment Act of Ontario defines "environment" in very broad terms as:

> "(i) air, land or water,
> (ii) plant and animal life, including man,
> (iii) the social, economic and cultural conditions that influence the life of man or a community,
> (iv) any building, structure, machine or other device or thing made by man,
> (v) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man, or
> (vi) any part or combination of the foregoing and the interrelationships between any two or more of them,
>
> in or of Ontario."

OWMC's goals in building and operating an industrial waste treatment and disposal facility and which have formed the basis for its Facilities Development Process are to:

- minimize risk to human health,
- minimize environmental impacts, and
- minimize financial costs to OWMC and the people of Ontario.

This chapter discusses the engineering features built into the design and operation of the proposed Facility in order to satisfy OWMC's goals in line with their philosophy that "special waste must undergo treatment to the fullest possible extent using the world's best proven technology, and the remaining residues must receive the most secure containment possible". In this respect, this chapter examines emissions and effluents released from the Facility, and safety features built into the design and operation of the Facility.

4.2 ENGINEERING FEATURES

Engineering features built into the design of the Facility in respect of environmental considerations are concerned with:

- emissions,
- landfill leachate,
- surface drainage,
- spill control/detection/clean-up,
- fire protection,
- monitoring - ground water/air/environment, and
- decommissioning.

4.2.1 EMISSIONS

Emissions of concern which may be released from the Facility include:

- flue gas emissions from the incineration plant stack,
- steam emissions from the evaporator stack, and
- fugitive atmospheric emissions.

The following sections provide an overview of emissions from the Facility.

4.2.1.1 Flue Gas Emissions from the Incineration Plant Stack

Table 4.1 presents the quality of treated flue gas expected from the incineration plant. It should be emphasized that the system design optimization (Ref: Monenco Limited[9]) and the flue gas quality predicted in Table 4.1 is supported by operating data from a similar operating facility (Ref: Maurer[7]).

Studies being conducted by Environ Corporation and Ontario Research Foundation to investigate health risks and compliance with Ontario Regulations respectively, base their work on data provided by OWMC's Incineration Technology Consultants, as presented in Table 4.1, published data on achievable destruction and removal efficiencies (DRE), together with other published data on specific emissions and more detailed emission data in course of preparation.

Where neither DRE information nor specific emission data is available on certain organic species, a conservative analysis is being undertaken to determine whether emissions of these organics are of concern.

The Process Area Report - Incineration (Ref: Monenco Limited[9]) explains how technologies for the incineration plant have been selected to meet OWMC's goals and planning principles. The approach adopted has been to select best available proven technologies and to optimize the design of the resultant incineration process system to attain the lowest achievable contaminant discharge levels.

Ontario Regulations are nevertheless an important benchmark against which predicted emissions from OWMC's Facility must be compared in order to verify compliance and also to determine, on a comparative basis, how well the proposed Facility will treat special wastes. This will be addressed by Ontario Research Foundation.

TABLE 4.1
EXPECTED FLUE GAS EMISSIONS

		Expected Maximum Emissions mg/Nm^3 (1)(2)	Expected Typical Emissions mg/Nm^3(1)(3)
Particulates		35	15
Hydrogen Chloride	(HCl)	35	15
Sulphur Dioxide	(SO_2)	175	150
Hydrogen Fluoride	(HF)	2	1
Nitrogen Oxide	(NO_x)	--(5)	200
Carbon Monoxide	(CO)	140	70
$C_{organic}$(5)		28	15
Metals			
Total Class I(4)		0.3	0.2
Mercury	(Hg)		
Cadmium	(Cd)		
Thallium	(TL)		
Total Class II(4)		1.4	1.0
Arsenic	(As)		
Chromium	(Cr)		
Cobalt	(Co)		
Nickel	(Ni)		
Selenium	(Se)		
Tellurium	(Te)		
Total Class III(4)		7.0	5.0
Antimony	(Sb)		
Lead	(Pb)		
Cyanide	(CN)		
Copper	(Cu)		
Manganese	(Mn)		
Vanadium	(V)		
Beryllium	(Be)	--(5)	0.14
Zinc	(Zn)	--(5)	5.0

Notes:

1. All values corrected to 50% excess air, (7% O_2) dry and at 0°C and 760 mm mercury.
2. Expected maximum emissions are expressed on the same basis as German Regulations (Ref: T.A. Luft[8]) wherein:
   - Values are 24 hour averages.
   - 97% of the half hour averages must not exceed the 24 hour average by more than 20%.
   - None of the half hour averages shall exceed the 24 hour average by more than a factor of two.
3. Expected typical values are expressed as half-hour averages.
4. Metal classes and the emission values for them are based on TA Luft (Ref: T.A. Luft[8]).
5. Organic carbon as determined by the Flame Ionization Detection method.

4.2.1.2 Steam Emissions from the Evaporator Stack

The combination of treatment technologies selected for the physical/chemical treatment plant result in a treated effluent of high quality (Ref: Monenco Limited[10]). This enables the treated effluents to be reused on site thereby minimizing the total quantity of treated effluent requiring evaporation.

Excess effluent is discharged as water vapour from the evaporator stack. Hence, the evaporator stack emissions consist mainly of water in the form of a visible steam plume, containing trace contaminants.

These trace contaminants are volatile organics. The relatively non-volatile inorganic components, such as dissolved salts, remain in the evaporator residues to be solidified and are disposed of in the engineered landfill.

The proposed physical/chemical treatment plant design ensures that the concentrations of residual organics in the treated effluents, prior to evaporation, are well below levels which would be of concern from a human health or environmental impact point of view, for the following reasons.

- The physical/chemical treatment plant removes a wide range of organic contaminants which could be of potential concern in the evaporator discharge.
- Batches of inorganic waste which contain high concentrations of organics not amenable to treatment by physical/chemical methods are incinerated.
- Batches of inorganic waste which contain unacceptably high concentrations of organics after physical/chemical treatment are either retreated or incinerated.

It is also important to emphasize that the operating philosophy for the physical/chemical treatment plant enables it to achieve treatment objectives higher than those required currently by the MOE for discharges to a municipal sewer, for the control of industrial waste discharges in Ontario and for provincial water quality (Ref: Monenco Limited[10]). Effluents unsuitable for reuse on site or discharge by evaporation are either:

- retreated in the physical/chemical treatment plant,
- solidified if the residual contaminants are inorganic in nature, or
- incinerated if the residual contaminants are organic in nature.

Table 4.2 presents predicted data on the expected quality of evaporator emissions for a number of organic and inorganic contaminants of potential concern to human health and the environment.

The selection of the twenty contaminants presented in Table 4.2 was based on the following:

- Together these contaminants represent a wide range of compound classes which are of potential concern to human health and the environment.

- All are known to be either toxic or to produce carcinogenic effects.

- Any of these contaminants could be present in measureable quantities in the inorganic or aqueous/organic wastes which require treatment in the physical/chemical treatment plant.

- Data are available on the range of contaminant concentrations which are likely to be present in untreated industrial wastes and on the treatability of these compounds by physical/chemical methods.

A conservative approach has been taken in calculating the expected emission rates by assuming that all organic contaminants in the evaporator feed will volatilize to the vapour phase and be discharged with the steam plume.

TABLE 4.2

ESTIMATED EVAPORATOR EMISSIONS

Contaminant	Expected Conc. In Influent to P/C Plant Average (mg/L)	Expected Conc. In Influent to P/C Plant Max. (mg/L)	Expected Avg Quantity of Waste Containing Contaminant (t/a)	Expected Conc. After Primary & Secondary Treatment (mg/L)	Expected Conc. After Polishing With Act.C & RO (mg/L)	Average Contaminant Discharge Rate From Evaporator (g/sec)
Pesticides						
• Aldrin	0.006	0.010	900	0.006	$6.0\text{x}10^{-5}$	$1.78\text{x}10^{-9}$
• Lindane	0.004	0.020	900	0.004	$6.0\text{x}10^{-6}$	$1.78\text{x}10^{-10}$
PCBs						
• Aroclor 1242	0.05	1.4	1000	$1.5\text{x}10^{-3}$	$1.5\text{x}10^{-5}$	$4.95\text{x}10^{-10}$
Halogenated Aliphatics and Methanes						
• Methylene Chloride	50.0	3400	36000	5	0.5	$5.94\text{x}10^{-4}$
• Carbon Tetrachloride	1.0	30	9000	0.05	0.013	$3.86\text{x}10^{-6}$
• Trichlorethylene	5.0	1300	9000	0.5	0.025	$7.42\text{x}10^{-6}$
• Chloroform	1.0	280	45000	0.1	0.006	$8.91\text{x}10^{-6}$
Halogenated Ethers						
• Bis (2-Chloroethyl) Ether	0.2	1.7	9000	0.2	0.1	$2.97\text{x}10^{-5}$

TABLE 4.2

ESTIMATED EVAPORATOR EMISSIONS (Cont'd)

Contaminant	Expected Conc. In Influent to P/C Plant		Expected Avg Quantity of Waste Containing Contaminant (t/a)	Expected Conc. After Primary & Secondary Treatment (mg/L)	Expected Conc. After Polishing With Act.C & RO (mg/L)	Average Contaminant Discharge Rate From Evaporator (g/sec)
	Average (mg/L)	Max. (mg/L)				
Aromatics & Chlorinated Aromatics						
• Benzene	5.0	46	27000	0.25	0.015	1.33×10^{-5}
• Hexachlorobenzene	0.1	5	7500	0.01	5.0×10^{-4}	1.24×10^{-7}
Polycyclic Aromatics						
• Acenaphthene	1.0	55	4500	0.5	0.012	1.78×10^{-6}
• Benzo (k) Fluoranthene	0.1	3.9	1800	0.01	0.001	5.94×10^{-8}
Phthalate Esters						
• Butyl Benzyl Phthalate	0.6	10	13500	0.03	6.0×10^{-4}	2.67×10^{-7}
Nitrosamines & Miscellaneous Organics						
• Acrylonitrile	10.0	46	4500	10.0	2.0	2.97×10^{-4}

TABLE 4.2

ESTIMATED EVAPORATOR EMISSIONS (Cont'd)

Contaminant	Expected Conc. In Influent to P/C Plant		Expected Avg Quantity of Waste Containing Contaminant (t/a)	Expected Conc. After Primary & Secondary Treatment (mg/L)	Expected Conc. After Polishing With Act.C & RO (mg/L)	Average Contaminant Discharge Rate From Evaporator (g/sec)
	Average (mg/L)	Max. (mg/L)				
Phenolics						
• 2,4,6 - Trichlorophenol	1.0	5.9	9000	0.2	0.002	5.94×10^{-7}
• 2 - Chlorophenol						
- Annual Avg	1.0	36	4500	1.0	0.02	2.97×10^{-6}
- 2 wk Avg	3.0		4500	3.0	0.06	8.91×10^{-6}
Inorganics						
• Arsenic	0.6	310	64000	0.1	0.05	2.64×10^{-9}
• Beryllium	0.1	0.9	73000	0.01	0.01	6.03×10^{-10}
• Chromium	20.0	1000	73000	1.0	0.05	3.02×10^{-9}
• Mercury - Annual Avg	2.0	120	54000	0.01	0.001	4.46×10^{-11}
- 2 wk Avg	6.0	-	54000	0.01	0.001	4.46×10^{-11}

Notes:

- Refer to Process Area Report (Ref: Monenco Limited[10]) for basis and methodology used to determine estimated emissions.

The data presented in Table 4.2 contains emission data being used to demonstrate compliance of emissions with Ontario Regulations and in the determination of health risks. This work is ongoing and being undertaken by Ontario Research Foundation and Environ Corporation respectively, and will be available prior to the formal environmental assessment submission.

4.2.1.3 Fugitive Atmospheric Emissions

The facility description (Chapter 3) and associated Monenco Process Area Reports (Ref: Monenco[9,10,11,12,13]) address in some detail the many design and operational features included to minimize the release of fugitive emissions to the atmosphere. These features are summarized below:

- Direct unloading of pumpable waste from tanker trucks to receiving tanks by interconnecting piping wherever feasible, to minimize the opportunity for release of fugitive emissions during unloading.

- Provision of ventilation systems for inground waste receiving tanks to effectively control fugitive emissions, complete with associated equipment for the removal of contaminants prior to the release of vent air to atmosphere.

- Receiving, storing and blending of waste prior to treatment in enclosed tanks equipped with vent systems which provide for the destruction and/or removal of contaminants prior to the release of vent gas or air to atmosphere.

- Exclusion of volatile organic wastes from storage pits at the incineration plant, designed to receive solid waste, and the enclosure and ventilation of these storage pits. Vent air will normally be discharged to the incinerator.

- Enclosed, ventilated facilities for the unloading, sampling, storing and preparation of drummed waste for treatment, including systems for removal of contaminants from vent air prior to its discharge to atmosphere.

- Storage of solid inorganic waste in enclosed pits at the solidification plant, with provision of a ventilation system for removal of particulates prior to release of vent air to atmosphere.

- Treatment of inorganic waste in enclosed vessels equipped with vent systems including scrubbers for removal of contaminants prior to release of vent gas/air to atmosphere.

- Enclosed delivery, transfer to storage and storage of treatment reagents, including systems for treatment of vent air from storage tanks and silos.

- Minimization of on-site inter-building transfers of potentially volatile or dusty materials which could result in the release of fugitive emissions. For example, incineration plant residues are solidified in dedicated equipment at the incineration plant.

- Transfer of solidified treatment residues to the landfill as a wet slurry or alternatively as a damp "soil-like" material, thereby minimizing the possibility of fugitive dusting of this material during transit to and unloading at the landfill operation.

- Maintenance practices which include regular inspection of equipment and attendance, as required, to correct leaking pump seals and similar sources of potential fugitive emissions. Regular monitoring/maintenance of vent scrubbing systems to ensure proper efficient operation.

- Good "house-keeping" practices to ensure speedy clean-up of on-site spills and/or leaks thereby minimizing fugitive emissions.

4.2.2 LANDFILL LEACHATE

Solidified residues deposited in the engineered landfill have received extensive prior treatment using best available proven technologies (Ref: Monenco Limited[9,10,11]). The design and hydrogeologic setting of the engineered landfill provides high level of containment/isolation from the environment (Ref: Monenco Limited[12]).

Preliminary findings by Gartner Lee Associates Limited indicate that leachate produced by the infiltration of water into the engineered landfill may take 800 to 1200 years to reach the underlying aquifer.

Ongoing assessment studies by Environ Corporation will examine potential effects on human health resulting from the transport of residual contaminants from the landfill to ground water systems. Monenco's input to these assessments are in course of preparation and involve the estimation of contaminant loading, for specific contaminants of concern deposited in the landfill.

Landfill leachate will be monitored on a regular basis. If necessary, it will be treated in the physical/ chemical treatment plant.

4.2.3 SURFACE DRAINAGE

The fundamental criterion for the design of the surface drainage system is that no water which could be contaminated will be discharged from the Facility before being tested to ascertain that it is safe to do so.

This criterion resulted in a decision to separate the drainage systems in the central operating area from those of the engineered landfill.

4.2.3.1 Central Operating Area

The surface drainage system manages surface runoff from precipitation, firewater, road wash and spillage in the central operating area as described in Section 3.7 (p. 207).

This is achieved by separating the surface drainage system into the following systems:

- uncontaminated,
- potentially contaminated, and
- contaminated.

Uncontaminated Surface Drainage

The uncontaminated surface drainage system collects runoff from clean areas such as building roofs and other areas where there is no operating equipment or vehicle traffic containing wastes, and discharges it by gravity into the uncontaminated surface water pond.

After rainfall runoff has collected, the contents of the pond are sampled and analysed to determine if the contents are contaminated. If uncontaminated, the water is pumped off-site and discharged into the Welland River. If contaminated, the contents are pumped to the physical/chemical treatment plant for treatment. (p. 118).

Flow rate and total flow of water being pumped to the Welland River is measured, sampled and monitored on-line for conductivity, pH, turbidity and hydrocarbon content. If any of these parameters fall outside preset limits, the system alarms and flow to the river is stopped. This on-line monitoring is primarily for record purposes and as a backup to the original sampling done prior to discharge.

Potentially Contaminated Surface Drainage

The potentially contaminated surface drainage system collects runoff from roads and other non-process areas which could become contaminated by a spill from a tank truck or a fire, and discharges it by gravity into the potentially contaminated surface water pond.

After rainfall runoff has collected, the contents of the pond are handled identically to the uncontaminated surface drainage. However, although both ponds can be emptied into the Welland River at the same time, the miscellaneous waste treatment system at the physical/chemical treatment plant is only sized to treat the contents from one pond at a time.

Contaminated Surface Drainage

The contaminated surface drainage system collects runoff from areas with outdoor operating equipment such as the incinerator tank farm.

Drainage from the curbed area around the pumps is collected and discharged directly into a sump sized to hold normal storm flows. On high level, the contents in the sump overflow to the potentially contaminated system.

After rainfall runoff has collected in the sump, the contents are sampled and, if clean, the water is pumped to the potentially contaminated sewer system. If it is contaminated, it is pumped to the aqueous organic storage tanks at the incinerator tank farm (p. 170) where it is disposed of by incineration, or at the physical/chemical storage tank area (p. 181) if it is to be treated in the aqueous organic treatment system (p. 114).

Storage tanks at the incinerator tank farm, incinerator receiving tanks, segregated organic storage tank area, and auxiliary fuel oil tanks are located in dyked areas and any spillage will be held within the dykes. After a rainfall, the drainage within the dykes is checked and, if clean, discharged to the potentially contaminated sewer by opening a closed valve. If found to be contaminated, it is drained to a sump and pumped to the aqueous organic storage tanks as described above.

In the event of a fire in the dyked area, the discharge valve from the area is opened to permit any firewater or organic waste to be discharged into the potentially contaminated sewer system.

4.2.3.2 Engineered Landfill

The surface drainage system for the landfill segregates potentially contaminated surface water from uncontaminated surface water and limits post-development 100 year storm water flows off-site to pre-development levels as described in Section 3.6.3.3 (p. 165).

Perimeter ditching is maintained around the entire site boundary to divert upstream surface drainage around the Facility to the existing downstream drainage channels. In addition, a berm is constructed on the inside of the perimeter ditch, to act as a drainage divide to keep on-site surface drainage separate from off-site surface drainage.

Uncontaminated Surface Water

Surface water which has no opportunity to come into contact with the solidified material is considered uncontaminated. This includes drainage from complete or undisturbed areas of the landfill.

This water is drained into the storm water management pond prior to off-site discharge. This pond serves both functions of storm water detention and sediment control.

Potentially Contaminated Surface Water

Any surface water which may come in contact with solidified material such as spillage from the pipeline or tracking from excavation by equipment, is considered potentially contaminated. Drainage from these areas is isolated and directed to potentially contaminated water storage ponds. Water in the ponds is tested before releasing to the surface drainage system. If found to be contaminated, the contents of the pond are discharged to the physical/chemical treatment plant for treatment.

Contaminated Surface Water

The perimeter of the excavated landfill area is bermed to prevent surface runoff from entering the excavation. The excavation will be further sub divided by a temporary berm separating the active excavation from the area of filling and underdrain construction. Precipitation collecting in the area of filling where there is likelihood of contact with the solidified material is treated as contaminated water or leachate. Precipitation collected on the other side of the berm where excavation is proceeding is considered potentially contaminated and will be pumped to a holding pond in the active landfill area.

4.2.4 SPILL CONTROL/DETECTION/CLEAN UP

The purpose for incorporating engineered containment into the design of the Facility is to minimize the opportunities for release of contaminants from the central operating area to either ground water or surface water systems.

The design of engineered containment systems, to minimize the opportunity for release of contaminants from the site via surface water systems, has been addressed previously in Section 4.2.3 (p. 268), which dealt with the design of storm water collection and discharge.

The criteria established for the design of the engineered containment system stipulate that:

- The design shall include engineered features to minimize the opportunity for the occurrence of contaminant pathways to the ground water system.

- Total reliance shall not be placed on the natural containment features of the site.

- Components of the Facility used to store pumpable liquid and sludge wastes must have two levels of engineered containment.

The two levels of engineered containment included in the facility design reflect these criteria.

4.2.4.1 Bulk Waste Unloading Areas

The design of bulk waste unloading areas is described in Chapter 3, Section 3.2 and includes below ground unloading tanks for certain organic waste types and for all inorganic wastes.

The organic and inorganic tank truck unloading areas have a double engineered containment system. This is achieved by steel or fibre reinforced plastic unloading tanks for organic and inorganic waste respectively, located in separate concrete pits for each below grade waste unloading tank.

This arrangement provides secondary containment and also permits access around the waste unloading tanks for inspection and repairs. In addition, each concrete pit drains to its own sump which is equipped with level alarms for detecting any spills or leaks. The sump is pumped out using a portable pump.

Below ground concrete pits located at the incineration plant and solidification plant, for receiving and storing dry organic and inorganic waste respectively, have steel liners. The steel liners provide assurance against the possibility of high ground water leaking into these pits.

4.2.4.2 Outdoor Storage Tank Areas

Outdoor storage tank areas are provided at the following locations:

- incinerator tank farm,
- incinerator waste receiving tanks,
- segregated organic storage tank area, and
- auxiliary fuel oil tanks.

The first level of engineered containment is provided by the integrity of the equipment. The second level of engineered containment, is provided by concrete dyked areas surrounding groups of tanks and curbed areas around pumps.

In the case of a spill in the dyked areas, the contents are held within the dyked area. The containment capacity is equal to a volume 50% greater than the largest tank. Most of the contents will be pumped to a tank truck or to another storage tank and the area cleaned to avoid contaminating normal storm drainage.

In the case of a leak or spill within the curbed area around the pumps, the leak is contained within the curbed area and drained to a sump.

4.2.4.3 Indoor Storage Tank Areas

Indoor storage tank areas are provided at the physical/chemical storage tank area.

The first level of engineered containment is provided by the integrity of the equipment. The second level of engineered containment is provided by concrete dyked areas surrounding groups of tanks and curbed areas around pumps.

Inorganic special wastes stored in the physical/chemical storage tank area are segregated into acidic, neutral/alkaline and aqueous organic wastes as described in Chapter 3 (p. 177). Acidic waste storage comprises four groups of six tanks, neutral/alkaline waste storage comprises five groups of six tanks and aqueous organic waste storage comprises one group of four tanks.

Each group of storage tanks is located in a concrete/tiled dyked area, sized to retain a volume 10% greater than the largest tank (in respect of acidic and neutral/alkaline wastes) and 50% greater than the largest tank (in respect of aqueous organic wastes).

The floor inside each dyked area is sloped to a sump and open trenches are provided within the dyked area to facilitate drainage to the sump. Spillage and/or wash water within dyked areas is discharged by a portable pump from the sump to one of the tanks within its group or to a drainage receiving tank. In the event that the dyked area overflows, it will overflow to the potentially contaminated sewer.

In the case of a leak or spill within the curbed area around pumps, the leak is contained within the curbed area and drains to trench drains. Trench drains pick up all leaks and/or wash water outside the dyked areas and discharge into pump sumps.

Separate trench drains and pump sumps are provided for acidic, neutral/alkaline and aqueous organic areas. The pump sumps comprise a removable tank located within a concrete manhole.

Duplex pumps, with automatic controls and low/high level alarms, discharge from the pump sumps into drainage receiving tanks or directly into their respective inorganic storage tank. Pump sumps contain an overflow capable of discharging the maximum firewater flow runoff into the potentially contaminated sewer system.

4.2.4.4 Process Areas

The main process areas include process systems comprising tanks, pumps, piping and special equipment which provide the first level of engineered containment. The second level of engineered containment is provided by:

- Concrete and/or tiled floors surrounded by curbs around process equipment areas.

- Lined concrete floor drains discharging into drainage sumps.

- Drainage sumps which comprise a separate sump tank located in a concrete pit.

- Sump tanks which include duplex pumps, automatic controls and low/high alarms and collect leaks, spills and wash water for discharge into drainage receiving tanks.

- Drainage sumps which overflow to the potentially contaminated sewer system.

4.2.4.5 Ponds

Ponds used to collect storm water, as described in Section 4.2.3 (p. 268), and for storing treated effluent prior to recycle or evaporation (p. 113) are designed with double synthetic liners to provide two levels of engineered containment. A permeable material is placed between the two liners to facilitate monitoring and rapid detection of a leak in the first liner.

4.2.5 FIRE PROTECTION

The fire protection system minimizes the consequences of fire. These consequences include property loss and temporary loss of treatment capability.

Preliminary discussions with the Smithville Fire Department and the Fire Marshall's office determined that the Facility be provided with a comprehensive on-site fire protection system which will be operated by facility operating staff trained in fire fighting and that the Smithville Fire Department, due to the voluntary status of their firemen, will provide back-up assistance.

Industry practice indicated that OWMC's Facility incorporate a high degree of fixed systems.

The proposed systems are based on industry practice and recommendations of Reed Stenhouse Limited, OWMC's "Loss Control Guidelines" specialist.

The proposed systems include divided water reservoirs, multiple fire pumps, well valved and looped underground fire water mains, fire hydrants, monitors, sprinklers and foam systems.

As discussed in Sections 4.2.3 and 4.2.4, in the event of a fire, fire water is contained within specific areas of the Facility and drains to the potentially contaminated surface water pond.

After a fire has been extinguished and the area cleaned up, the contents of the potentially contaminated pond is sampled and analysed to determine the extent of any contamination and treatment requirements as described in Section 4.2.3.

4.2.6 MONITORING

Preceding sections of this chapter have addressed some of the features which have been included in the design and operation of the Facility to ensure that risks to human health and environmental impacts from the operation of OWMC's Treatment Facility are minimized.

This section addresses the monitoring that OWMC proposes to undertake to ensure that the Facility operates properly.

A monitoring program is being developed for:

- On-site monitoring as a comprehensive quality assurance program to control incoming special waste, treatment processes, residues, effluents and emissions.

OWMC's monitoring program will continue to evolve as a result of:

- detailed engineering design,
- results of the Phase 4B biophysical and socioeconomic field programs,
- discussions with the community of West Lincoln, and
- requirements of the Ministry of the Environment as a condition of approval for OWMC's proposed Treatment Facility.

4.2.6.1 On-Site Monitoring

On-site monitoring ensures that OWMC's treatment objectives are being achieved in accordance with OWMC's goals to minimize risks to human health and environmental impacts as follows:

- Tracking the special wastes from the time a waste generator submits a sample for treatability testing, through its treatment process and ultimate disposal.

- Performance and process monitoring and sampling to confirm that the treatment processes are functioning correctly.

- Implementation of a detailed inspection plan to ensure the safety of the Facility at all times.

- Environmental monitoring and sampling to complement routine monitoring for process control and to:

  - ensure the safety of plant personnel, the general public and the environment, and
  - ensure compliance with government standards and regulations.

Tracking Special Wastes

Tracking special wastes is achieved using the data management system and involves the following steps:

- sample received from the waste generator for treatability testing,
- treatment processes determined and delivery of special waste scheduled, if the generator elects to use OWMC's Facility,
- waste delivery received at gatehouse, documentation verified and load weighed in,
- waste "fingerprint" tested and unloaded,
- waste transfered to storage,
- waste transferred to its specified treatment process,
- residues from treatment processes disposed of in engineered landfill, and
- effluents from treatment processes disposed of by evaporation as required.

Performance and Process Monitoring and Sampling

Monitoring and sampling is conducted at all the process areas as follows:

Incineration Plant. Sampling of blended wastes is conducted in order to verify that important parameters such as heating value, chlorine and sulphur content are within prescribed limits.

The concentration of the following stack gas contaminants will be monitored, to ensure optimum operation of the incineration system:

- carbon monoxide (CO),
- sulphur dioxide (SO_2),
- nitrogen oxides (NO_x),
- hydrogen chloride (HCl), and
- total hydrocarbons (THC).

(Note: Organic carbon content will be determined by the flame ionization detection method. Under US Environmental Protection Agency regulations, this organic carbon content is expressed as a methane equivalent to indicate total hydrocarbon content of the flue gas.)

In addition, periodic stack sampling is conducted for selected contaminants which cannot be continuously monitored e.g. heavy metals.

Samples of boiler ash and salt (residue) are taken periodically for analysis and solidification treatability tests to ensure that the optimum formulation is being used. The relative consistency of the residue stream will permit batches of these materials to be solidified as they are received from the incineration process without waiting for the results of specific treatability tests on each sample. This would in any case be impractical due to the time required.

Samples of slag taken for analysis to confirm its suitability for disposal directly in the engineered landfill.

Continuous and intermittent analysis of samples from various locations in the steam, feedwater and condensate systems (associated with the waste heat recovery boiler of the flue gas cooling system), are conducted to ensure the efficient operation of the waste heat recovery boiler.

Physical/Chemical Treatment Plant. Sample analyses and treatability test information are used to establish treatment recipes for wastes prior to physical/chemical treatment.

Quality control checks are carried out during the treatment sequence to ensure that treatment is proceeding as planned.

Samples of filtrate in the intermediate storage tanks are taken to confirm that secondary treatment has produced a filtrate of acceptable quality prior to effluent polishing.

Samples of final polished effluent in the final effluent storage tanks are taken and tested for quality prior to recycling on-site or discharging by evaporation.

Solidification Plant. Sample analyses and treatability testing are carried out to establish treatment recipes for residues prior to solidification.

Quality control/checks are carried out in accordance with the established testing protocol for the Facility.

The quality of residues sent to solidification and of the solidified material disposed of in the engineered landfill are monitored to ensure that they can be safely disposed of in the landfill.

Engineered Landfill. Samples of leachate from the landfill are tested for quality to confirm the results of the treatability testing of the solidified material.

Inspection Plan

In order to ensure the safety of the Facility at all times, detailed inspections will be made by the Safety Officer. He will carry out periodic and routine inspections to satisfy himself that the safety of personnel and the public is not compromised in any manner. This inspection will include:

- Roads, paved areas, curbs and catch basins to ensure that cracking of surfaces, that could provide a potential contaminant leakage path in the event of a spill, are identified and repaired.

- Equipment and maintenance records.

- Safety equipment such as fire detection and protection systems, safety showers, eye washes etc. to ensure they are kept in a state of readiness at all times.

- Routine inspection of all storage areas such as drum storage, tank farms to ensure there are no leakages of special waste in storage areas.

- General inspection of all areas to ensure cleanliness in order that any leaks from valves, fittings, pump seals etc., can be identified, repaired and any residual contamination cleaned up.

Environmental Monitoring and Sampling

Environmental monitoring and sampling will be concerned with any potential source of contaminant discharge which could pose a risk to plant personnel, the general public or the environment. Contaminant discharges may be released in gaseous, liquid or solid form.

Gaseous emissions will consist mainly of volatile organic compounds and acid gases in very small concentrations, released during normal operation from ventilation air pollution control equipment.

Aqueous discharges will consist mainly of storm water run-off which has been tested and shown to be uncontaminated. There is also the potential for releases through the ground from in-plant leakage and spillage.

Solid emissions will consist primarily of particles of salts or metals in minute quantities, transported with gaseous emissions or air as fugitive emissions.

Tables B.1 to B.7 in Appendix B list the known sources of controlled emissions, the expected contaminants and recommended frequency of sampling, including methods of analysis for each of the main processing areas. In addition Tables B.8 and B.9 provide an indication of the extent of monitoring required for the landfill area and central operating area.

4.2.7 DECOMMISSIONING

When the Facility is nearing the end of its useful life, either by reason of obsolescence of treatment processes, reduced demand for its services or aging equipment, a decision to decommission the plant will become necessary. The objective of decommissioning a plant is to leave the site in an environmentally safe condition consistent with its surroundings and proposed future use.

The Province of Ontario has developed guidelines specific to the decommissioning of industrial plants which provide a mechanism for continuing communication between the owner and the regulatory agency. These guidelines address:

- on-site waste treatment,
- hydrogeologic and soil investigations,
- disposal of materials accumulated on-site, and
- end land use.

The guidelines specifically require that, during decommissioning, discharges from waste treatment facilities do not exceed those allowed in the plant's operating licence.

As the whole OWMC Treatment Facility is dedicated to handling and treating waste, the approach to decommissioning must include all facets of the process from the reception of waste to the deposition of residues in the landfill. Decommissioning will require a process of governmental and public consultation similar to that necessary to obtain approvals for construction of the proposed Facility.

CHAPTER 5
FACILITY CHARACTERISTICS INFORMATION

5.1 INTRODUCTION

Facility characteristics information characterizes the proposed Facility, for use by other consultants in their environmental impact assessment. This chapter documents the characteristics of the Facility, established as engineering input to this site assessment work. OWMC's environmental consultants are currently evaluating the potential impacts and risks associated with these facility characteristics.

This information characterizes the Facility from commencement of construction, through start-up and operation of the 150 000 t/a Facility. Additional information is provided for the 300 000 t/a Facility where required for sensitivity analyses conducted as part of the site assessment work.

Following the selection of the site in West Lincoln, site specific information became available from other OWMC consultants. This information was incorporated, along with Monenco's own on-site and site vicinity investigations, into the preliminary engineering which produced the conceptual design of the proposed Facility described in this report.

Facility characteristics information is provided under the following headings:

- base line monitoring,
- construction of the Facility,
- initial start-up of the Facility, and

- operation of the Facility:
  - transportation requirements, waste quantities and characteristics,
  - emissions and effluents,
  - engineered containment,
  - anticipated noise levels,
  - visual appearance,
  - dust,
  - hours of operation,
  - employment levels,
  - services for the Facility, and
  - taxation and zoning.

5.1.1 BASELINE MONITORING

A period is planned during which monitoring of the atmospheric and hydrogeologic conditions at the site will take place, prior to any impacts on the environment coming into effect, as a datum for the site assessment.

5.1.1.1 Atmospheric

To put into effect the monitoring, Monenco have confirmed a suitable physical location for the atmospheric monitoring tower (see Figure 3.3).

5.1.1.2 Hydrogeologic

Monenco have also provided input to the physical locations of the hydrogeologic monitoring stations.

5.1.2 CONSTRUCTION OF THE FACILITY

The construction of OWMC's Treatment Facility of 150 000 t/a capacity is proposed in accordance with detailed construction plans. The highlights of this plan are as follows:

- 18 month schedule.

- Normal working week (8 hours/day, 5 days/week) with no overtime envisaged.

- Average construction labour force of 360 with a peak of about 600 occurring during month 10 through 16.

- Principal trades will be pipe fitters, welders, electricians, ironworkers, boilermakers, carpenters and labourers, although most other trades will be represented.

- The site is within commuting distance of a large pool of construction labour.

- No construction camps required.

- Construction labour will travel to site in their own cars, car pools and special buses.

- Services, local trade subcontractors, machine shops, hardware, catering and fuel supplies will be obtained locally, where practical.

- All construction work will be carried out to the standards of the Construction Safety Act of Ontario. This will include a construction site safety program, safety inspectors and supervisors, suitable ambulance and first aid service on site and cooperation with the local medical services.

- Construction dust will be generated from the brief earth moving operation during the first 2 to 3 months, from vehicular movement on the construction site. The permanent site road beds will be installed at the start of the initial facility work and will be kept clean in order to keep dust to a minimum.

- The initial work at site will also include the installation of fencing and drainage, with earth moving activities carried out only where absolutely necessary. This will minimize erosion of the site and carry over of clay/mud to the neighbouring roads.

- Noise from the site will be typical for construction of most process type plants of this size, with trucks entering and leaving the site every ten minutes (on average) during the working day over the eighteen month period. The peak noise would probably be during the earth moving phase, when dump trucks, D9 bulldozers and Euclid scrapers are in operation on site, eight hours per day over a duration of 8 to 12 weeks. During the mechanical erection phase of the project, approximately 12 months, the noise will be mainly due to air compressors and welding machines (gas driven) running continuously during the working day. There will also be a background of general site noise accompanying pipe fabrication and erection of steel work.

5.1.3 INITIAL START-UP OF THE FACILITY

Upon completion of construction, component systems of the Facility will be pressure/seal tested in accordance with codes and specifications, followed by cleaning of component systems and general site clean-up. Pre-start-up activities such as installation of on-line instruments, running in of rotating equipment and "ready for start-up" checks will follow.

The initial start-up of the Facility will be carried out in accordance with established procedures.

The incineration plant will be started up first on virgin fuel prior to the introduction of waste material, under conditions as close to regular operation as possible. During this testing, all incineration plant components will be checked out carefully to demonstrate the performance of each component as well as the incineration plant as a whole. The initial start-up procedures will ensure that all operating parameters are maintained within acceptable limits. The incineration plant will be shut down immediately if these limits are exceeded for longer than predetermined periods.

Performance testing of the incineration plant will demonstrate that the plant can operate safely and that emissions are within the acceptable levels for regular operation.

The physical/chemical treatment and solidification plants are operated in a batch mode, whereby initial start-up activities are essentially the same as those for regular operations. The performance of these batch operating processes can be predetermined by treatability tests in the laboratory. Emissions, during the initial start-up, from these plants will be within the acceptable levels established for regular operation.

Initial start-up of other continuously operating systems (such as vent emission control system, p. 237) will be in accordance with the established procedures. Emissions will be within the acceptable limits for regular operation.

5.1.4 OPERATION OF THE FACILITY

The characteristics associated with operation of the Facility are based on a 150 000 t/a Facility operating in the year 1995 A.D. with exceptions noted to account for the build up during the first five years of operation.

5.1.4.1 Transportation Requirements

Quantity of Special Waste

The quantity of special waste to be treated at OWMC's Treatment Facility will increase to 150 000 t/a by year 5 as follows:

	Quantity of Special Waste (t/a)		
• Year of Operation	Total	Organic	Inorganic
1	50 000	20 000	30 000
2	70 000	20 000	50 000
3	105 000	25 000	80 000
4	130 000	30 000	100 000
5	150 000	30 000	120 000
Subsequent years, for life of Facility	Quantities will remain constant every year at the levels shown for year 5.		

The three operating scenarios, the Typical Case, High Effluent Case and the High Solidified Case are reflected in the Tie-Ins Schedule (Appendix C.1) and as described in this report (p. 20).

When the Facility is expanded to 300 000 t/a, the quantities will increase from year 6 to year 10 as shown below and remain constant at this level in subsequent years, for the life of the Facility.

Quantity of Special Waste (t/a)

• Year of Operation	Total	Organic	Inorganic
6	180 000	36 000	144 000
7	210 000	42 000	168 000
8	240 000	48 000	192 000
9	270 000	54 000	216 000
10	300 000	60 000	240 000

Characteristics of the Special Wastes

The characteristics of the 150 000 t/a of special wastes are presented in Appendix A.

Transportation of Special Wastes, Additives and Reagents

The quantities of special wastes are shown on Table 5.1 (p.296). The quantities of additives and reagents are shown on Table 5.2 (p. 297).

5.1.4.2 Emissions and Effluents

Emissions and effluents are defined as gaseous and liquid discharges respectively, which are released from the Facility and include:

- emissions from the incineration plant stack,
- emissions from the evaporator stack,
- fugitive atmospheric emissions,
- sanitary sewage effluent, and
- uncontaminated surface drainage.

Stack and Fugitive Atmospheric Emissions

Expected stack emissions from the incinerator and evaporator are presented in Tables 4.1 and 4.2 respectively.

Monenco's Phase 4A Report (Ref: Monenco Limited[6]) provides an assessment of the fugitive emissions associated with the proposed Facility.

A more detailed assessment is presently on-going, based on the conceptual design described in this report. Additional work is presently being conducted by other OWMC consultants to address compliance of the facility emissions with Ontario regulations and to determine health risks resulting from such emissions. This work is on-going and being undertaken by Ontario Research Foundation and Environ Corporation respectively and will be available prior to the formal environmental assessment submission.

Sanitary Sewage Effluent

Sanitary sewage from the site will be treated on-site and the treated effluent will be discharged with the uncontaminated surface drainage.

Uncontaminated Surface Drainage

It has been determined that on-site uncontaminated surface drainage (clean storm water) will be controlled and discharged off-site to the Welland River via a sewer as shown in Table 5.7 (p. 306) and Figure 3.4 in Chapter 3 (p. 28). Perimeter drainage will be routed to existing drainage systems (p. 165).

5.1.4.3 Engineered Containment

Engineered containment is described in Chapter 3 (p. 254). In addition, specific information is provided in Monenco's Phase 4A Report (Ref: Monenco Limited[6]).

5.1.4.4 Anticipated Noise Levels

The anticipated noise levels were estimated for the equipment associated with each area shown on the Figure 3.2 (p. 26) and summarized in Appendix C.2.

The anticipated noise levels associated with operation of the landfill are also provided in Appendix C.2.

5.1.4.5 Visual Appearance

The appearance of the Facility is determined by numerous features such as heights, shape, colour, textures and finishes to the buildings and structures. A general understanding of these features can be obtained by reference to the following:

- A perspective of the 150 000 t/a integrated Facility is shown on Figure 3.1 (p. 25).
- Figures 3.2 and 3.3 show the site layout and the central operating area within the overall site, with the remaining area of the site used for landfill.
- Building and pond sizes are summarized in Table 5.3.
- The Facility will be enclosed by a 3 m high chain link fence topped with three strands of barbed wire. Fencing will be around the central operating area, around the site acquisition boundary and along the access road between the site acquisition boundary and the central operating area.
- The landfill will be the "shallow entombed" type and will be developed by the area method.
- The landfill development will be at least 50 m in from the site acquisition boundary.
- Provision will be made for the landfill to have a 5 m high berm around the site, located just inside the fence.
- Landfilled areas will be revegetated. The lag time from closing an area, for vegetation to be established, is approximately one year.

- The central operating area and roadways will be lit all night with lighting focused downwards and hence should not cast light outside the technical buffer zone.

- The incinerator stack will be lit in accordance with the requirements of Transport Canada, which requires two red dual unit flashing hazard beacons located 6 feet below the top of the stack and two dual unit red steady burning obstruction lights at the half way point. The lights must be visible from any angle around the stack.

- Landfill operations are planned for daylight hours. Local mobile lighting units will be provided for safety during infrequent nighttime operation.

- The incinerator stack will be made of concrete, and may be tapered. For the first incinerator installation, the stack will contain one flue, from which a plume will be emitted. This plume will be visible at most times during the year, but will be even more visible in cold weather.

  The expanded facility with a second incinerator will utilize the same stack with a second flue.

  The additional incinerator will contribute to an increase in the volume of discharge and increase to the plume.

- The evaporator discharge is a single stack which may be supported from the physical/chemical building and be free standing above the roof line. Consideration will be given to it being of similar construction to that of the incinerator stack.

A range of operating scenarios (p. 20) will occur during which the evaporator system will either produce little or no discharge to atmosphere, or in the opposite extreme produce visible quantities of steam as a plume for long periods.

- The auxiliary boilers will normally be fired with gas though light oil will be available for backup.

  Under normal circumstances, when gas is being burned, a visible plume caused by water vapour is expected and will be particularly noticeable in cold weather. During periods when oil is being used, it is unlikely that the plume will be visible except during very cold periods.

- Various piping systems and vessels in the Facility will be fitted with relief valves that exhaust via a pipe to atmosphere. These relief valves do not activate during normal operating conditions.

  In the unlikely event of an operating upset resulting in the activation of a relief valve, a steam or vapour exhaust plume will become visible for a short duration.

  The height of the vent pipes is generally 30 meters above grade. The vents normally extend to approximately 3 meters above the roof line of buildings.

  At this conceptual stage the location of these relief valves and discharge vents has not been determined.

5.1.4.6 Dust

The potential sources of dust at the Facility are summarized as follows:

- Excavation and stockpiling of soils during initial area development:

  - Potential for dust generation is low because soils will have high moisture content.
  - Frequency - continual.

- Desiccation of stockpiled soil from on-going operations and wind generated dust:
  - This is a possibility and might be controlled through the use of soil stabilization agents or grassing of stockpiles.
  - Frequency - continual.

- Dust generation by vehicles during filling of landfill area:
  - This is a possibility since most of the solidified material is trucked to landfill.
  - Source could be either road dust or dust from exposed surfaces of solidified mass that are subject to traffic.
  - Road dust will be minimized by the use of good all weather granular road surfaces and light application of dust control chemicals or water applied to road surface if required during dry spells.
  - Regular road cleaning and maintenance will help minimize dust.
  - Dust generated from the solidified mass by wind or vehicular traffic will be controlled by minimizing the time of exposure of surfaces.
  - Frequency - continuously, 5 days per week.

- Dust generated by handling and placement of clay and topsoil during placement of final cover over filled areas:

  - Although stockpiled materials are likely to have reasonably high moisture content there is some potential for dust generation but it would be short term.
  - There is also a potential for dust generation by wind until the vegetation cover is established on the topsoil. This will be minimized through the use of soil stabilizing agents as required.

- Frequency - continuously, 5 days per week.

Specific dust sources at the Facility are presented in Tables 5.4 and 5.5.

5.1.4.7 Hours of Operation

Incineration Plant

- Operation will be 24 hours/day, 7 days/week, 7 000 hours/year.

Physical/Chemical Treatment Plant

- Operation for 50 000 t/a will be 8 hours/day, 5 days/week, 50 weeks/year. Increased capacity will be handled by working additional hours to the maximum of 24 hours/day.

Solidification Plant

- Operation will be 8 hours/day, 5 days/week, 50 weeks/year. Increased capacity will be handled by working additional hours to the maximum of 24 hours/day in accordance with the requirements of the physical/chemical treatment plant.

Engineered Landfill

- Operation of the landfill will be 8 hours/day, 5 days/ week, 50 weeks/year.

- Transportation of material from the central operating area to the landfill by pipeline or trucks will be 8 hours/day, 5 days/ week, 50 weeks/year.

- Transportation of material from the solidification plant to the landfill by pipeline could be upto 24 hours/day, but landfill operations using heavy equipment, such as bulldozers and compactors will be during daylight hours only.

5.1.4.8 Employment Levels

- When operating at a capacity of 150 000 t/a it is expected that there will be 151 Operations' employees, as detailed in Table 5.6.

5.1.4.9 Services for the Facility

- Services required for the operation of the Facility include:
  - surface water drainage discharge (clean storm water),
  - sanitary sewage,
  - water from watercourses (raw water),
  - natural gas,
  - electric power, and
  - telephone.

- Services will use existing road allowances for routing, where possible, and will be buried, except for electric power which will use overhead pole lines. Sources of services are listed in Table 5.7 (p. 306) and are shown on Figure 3.4 (p. 28). Additional information is presented in "Off-site Tie-ins" in Appendix C.1.

TABLE 5.1

TRANSPORTATION QUANTITIES OF SPECIAL WASTES

Description	150 000 t/a Facility (Year 5) Typical Operation Tonnes per Year
Pumpable Waste	11 050
Non-Pumpable Waste	7 870
Drummed Waste	11 080
Total Organic Waste	30 000
Pumpable Waste	83 700
Non-Pumpable Waste	35 100
Drummed Waste	1 200
Total Inorganic Waste	120 000
Total Waste	150 000

TABLE 5.2

TRANSPORTATION QUANTITIES
ADDITIVES, REAGENTS AND EXCAVATED MATERIAL

Treatment Process	Additive or Reagent	Physical State	Quantity Delivered per Year (Tonnes)
Solidification Plant	- cement	powder	12 240
	- sodium silicate	liquid	1 300
	- lime	powder	320
	- clay	powder	320
	- fly/ash	powder	320
Solidification Plant (at Incineration Plant)	- cement	powder	1 080
Physical/Chemical Treatment Plant	- caustic (50%)	liquid	5 810
	- lime	powder	260
	- sulphuric acid (93%)	liquid	715
	- ferric chloride (37%)	liquid	30
	- sodium bisulphite (37%)	liquid	1 000
	- sodium hypochlorite (10.8%)	liquid	1 000
	- sodium hydrosulphide (45%)	liquid	20
	- polyelectrolyte	powder	11
	- filter aid	powder	51
	- activated carbon	granules	200
	- nitrogen	liquid	15
Incineration Plant	- lime	powder	1 400
	- caustic (50%)	liquid	1 300
	- sulphuric acid (93%)	liquid	16
	- salt	granules	77
	- sodium sulphite	liquid	1.5
	- morpholine	liquid	2.0
	- tri sodium phosphate	powder	0.5
	- nitrogen	liquid	85
Landfill	- granular material	granules	7 100
	- excavated material	earth/clay	80 000

TABLE 5.2

TRANSPORTATION QUANTITIES ADDITIVES, REAGENTS AND EXCAVATED MATERIAL (Cont'd)

Treatment Process	Additive or Reagent	Physical State	Quantity Delivered per Year (Tonnes)
General Facilities	- sodium hypochlorite (10%)	liquid	15.6
	- alum	liquid	15.6
	- polyelectrolyte	powder	0.1
	- pulverized clay	powder	0.8
	- caustic	liquid	570
	- activated carbon	granules	75

Notes: 1) Based on Year 5 (150 000 t/a waste delivered) typical operation.

2) This table lists the major additives and reagents delivered to the Facility. In order to allow for additional chemicals and/or additional quantities a 5% allowance should be added to the above quantities.

3) Excavated material used for berms and dykes. Excess material exported from year 5 (80 000 t/a) and in subsequent years (180 000 t/a).

TABLE 5.3

BUILDING AND POND SIZES
FACILITY CAPACITY: 150 000 t/a

1.	Administration Building	85 x 32 x 7H
2.	Maintenance Building	57 x 27 x 6H
3.	Gatehouse & Weigh Scales	Not Applicable
4.	Solidification Plant	50 x 47 x 19
5.	Physical/Chemical Treatment Plant	70 x 64 x 24H
6.	Physical/Chemical Storage Tank Area	70 x 45
7.	Inorganic Drum Storage & Handling Building	54 x 37 x 8H
8.	Inorganic Tank Truck Unloading Area	52 x 19 x 8H
9.	Incineration Plant	88 x 46 x 15H
10.	Organic Drum Storage & Handling Building	77 x 50 x 7H
11.	Incinerator Tank Farm	77 x 45
12.	Organic Tank Truck Unloading Area	26 x 23 x 8H
13.	Incinerator Waste Receiving Tanks	34 x 10
14.	Segregated Organic Storage Tank Area	34 x 27
15.	Storage Building	55 x 23 x 8H
16.	Main Substation	20 x 20 x 4H
17.	Emergency Power Station	20 x 20
18.	Surface Water Pumphouse	12 x 8 x 4H
19.	Sanitary Sewage Plant	8 x 4 x 4H
20.	Raw Water Treatment Plant	12 x 10 x 4H
21.	Firewater Pumphouse	12 x 8 x 4
22.	Surface Water Pond (Potentially Contaminated)	75 x 60 x 5 (Depth)
23.	Surface Water Pond (Uncontaminated)	75 x 60 x 5 (Depth)
24.	Firewater Pond 2	50 x 45 x 5 (Depth)
25.	Solidified Material Interim Storage Building	20 x 15 x 8H
26.	Solidified Material Conveyor	Not Applicable
27.	Drum Conveyor	Not Applicable
28.	Incinerator Stack	60H x 4 (Diameter)
29.	Auxiliary Boiler Stack	30H x 2.5 (Diameter)
30.	Evaporator Stack	45H x 0.8 (Diameter)
31.	Piperack	Not Applicable
32.	Temporary Truck Holding Area (Organic)	Not Applicable
33.	Truck Holding Area (Organic)	Not Applicable
34.	Temporary Truck Holding Area (Inorganic)	Not Applicable
35.	Truck Holding Area (Inorganic)	Not Applicable
36.	Car Park	Not Applicable
37.	Emergency Road, Hydro & Gas Corridor	Not Applicable
38.	Landfill Storm Detention Pond	50 x 40 x 5 (Depth)
39.	Meteorological/Air Monitoring Station	10 x 10
40.	Recycle Water Pond	60 x 35 x 5 (Depth)
41.	Evaporator Feed Pond	77 x 60 x 5 (Depth)
42.	Truck Load Out Station	6 x 6 x 16H
43.	Truck Wash Station	25 x 15 x 6H
44.	Truck Wash Station (Future)	Not Applicable
45.	Evaporator/Recycle Pumphouse	20 x 12 x 4H
46.	Not Used	
47.	Effluent Storage Tanks	22 x 22

Note: All dimensions in metres.

TABLE 5.4

DUST SOURCES FROM MATERIAL DELIVERIES TO THE FACILITY

REF:	MATERIAL	TRANSFER MEANS	POINT SOURCE OF DUST	LOCATION AND REFERENCE NUMBER FROM SITE PLAN FIGURE 3.3	DESIGN FEATURES INCLUDED TO MINIMIZE EMISSIONS
1.	Lime (as fine powder)	Delivered to site by trucks with pneumatic unloading	Small quantities of residual dust will emanate from bag filter at pressure relief valve on top of silo during filling.	Incineration Plant (#9) - Lime Storage Silo	Silo vents are fitted with bag filters.
2.	Lime (as fine powder)	Delivered to site by trucks with pneumatic unloading	Small quantities of residual dust will emanate from bag filter at pressure relief valve on top of silo during filling.	Phys/Chem Plant (#5) - Lime Storage Silo	Silo vents are fitted with bag filters and bag filters are within the building.
3.	Salt for scrubber softener regeneration (in granular form)	Delivered to site in bags and manually poured into saturator tank	Dust may be emitted when salt is being poured into the tank through open lid	Incineration Plant (#9) - Scrubber Saturator tank	Tank is within the building.
4.	Cement (fine powder)	Deliverd to site by trucks with pneumatic unloading	Small quantities of dust will emanate from the bag filter at the top of silo during filling.	Solidification Plant (#4) - Cement Storage Silo	Silo vents are fitted with bag filters. The silo is within the building.
5.	Cement (fine powder)	Delivered to site by trucks with pneumatic unloading	Small quantities of dust will emanate from the bag filter at the top of silo during filling.	Solidification Area at Incineration Plant (#9) Cement Storage Silo.	Silo vents are fitted with bag filters. The silo is within the building.
6.	Polyelectrolyte (coarse granular particles)	Delivered to site in bags and manually poured into the tank	Very minor amounts of dust may be emitted above the tank as polyelectrolyte is being manually poured through open lid	Phys/Chem Plant (#5) Polyelectrolyte tank	Tank is within the building.
7.	Solid Inorganic Waste requiring phys/chem treatment	Delivered to site in drums or dump trucks	Dust may be generated when dry waste is dumped from drums or trucks into open storage bunker.	Solid Inorganic Pit (slurry system) at Solidification Plant (#4)	Storage bunkers are within the building. Wall separates the bunkers from the rest of the building.

TABLE 5.4

DUST SOURCES FROM MATERIAL DELIVERIES TO THE FACILITY (Cont'd)

REF:	MATERIAL	TRANSFER MEANS	POINT SOURCE OF DUST	LOCATION AND REFERENCE NUMBER FROM SITE PLAN FIGURE 3.3	DESIGN FEATURES INCLUDED TO MINIMIZE EMISSIONS
8.	Organic Dry Bulk Solid Wastes	Deliverd to site in dump trucks	Dust may be generated when dry waste is dumped from trucks into the open bunker.	Incineration Plant (#9) Waste Storage Bunker	Storage bunkers within the building. The building is under negative pressure and its vent is routed to the kiln.
9.	Flyash, (as fine powder)	Delivered to site by trucks with pneumatic unloading	Small quantities of residual dust will emanate from bag filter on top of the hopper during filling.	Solidification Plant (#4) Flyash Hopper	Bag filter at hopper vent. Hopper is within the building.
10.	Lime (as fine powder)	Delivered to site by trucks with pneumatic unloading	Small quantities of residual dust will emanate from bag filter on top of the hopper during filling.	Solidification Plant (#4) Lime Hopper	Bag filter at hopper vent. Hopper is within the building.
11.	Solid Inorganic Waste	Delivered to site in dump trucks	Dust may be generated as dry solids are dumped into the open storage bunker.	Solidification Plant (#4) Waste Storage Bunker	Bunkers are within the building. A wall separates the bunkers from the rest of the building.
12.	Clay (fine powders)	Delivered to site in bags	Dust will be generated as bags are split at the bag unloader.	Solidification Plant (#4) Clay Hopper	The bag splitter is fitted with a dust collection hood.

- For quantities of reagents and additives being delivered to site refer to the Appendix C.1.
- For particulate discharge from incinerator stack see Table 4.1.

TABLE 5.5

DUST SOURCES FROM MATERIAL TRANSFERS WITHIN THE FACILITY

REF:	MATERIAL	TRANSFER MEANS	POINT SOURCE OF DUST	LOCATION AND REFERENCE NUMBER FROM SITE PLAN FIGURE 3.3	DESIGN FEATURES INCLUDED TO MINIMIZE EMISSIONS
1.	Boiler Ash (granular, but coarser than flyash)	Conveyors	Dusting may occur during upset event involving conveyor blockage and removal of conveyor casings to unblock	Solidification Area at Incineration Plant (#9) - mixers	Conveyors are enclosed.
2.	Salt/Ash (fine powder)	Conveyors	Dusting may occur during upset event involving conveyor blockage and removal of conveyor casings to unblock	Solidification Area at Incineration Plant (#9) - mixers	Conveyors are enclosed.
3.	Organic Dry Bulk Solid Wastes (stored in waste bunker)	Overhead Grab Crane	Dust may be generated when grab picks up waste from waste bunker and drops it into the Rotary Kiln feed chute.	Incineration Plant Unloading Area (#9) Rotary Kiln feed chute	Storage bunkers are within building. The building is under negative pressure and its vent is routed to the kiln.
4.	Inorganic Solid Residues (stored in waste bunker)	Overhead Grab Crane	Dust may be generated when grab picks up waste from the waste bunker and drops it it into the Receiving Hopper	Solidification Plant (#4) Unloading Area Receiving Hopper	Storage bunkers are within building. A dust wall separates the bunkers from rest of the building.

TABLE 5.6

EMPLOYMENT LEVELS

150 000 t/a CAPACITY

Category	Total
GENERAL ADMINISTRATION	
Director of Operations	1
Manager, Operations	1
Manager, Administration & Services	1
Manager, Engineering Maintenance	1
Manager, Analytical Services	1
Supervisor, Marketing	1
Supervisor, Office Services	1
Supervisor - Personnel	1
Comptroller	1
Security Officer	1
Safety & Training Officer	1
Site Superintendent	
Secretaries	5
Marketing/Sales/Purchasing	4
Accounting	5
Plant Engineering	
Mechanical Engineer	1
Chemical Engineer	1
Draftsmen	1
Security Personnel	5
Nurse	1
Clerks	3
Subtotal	37
MAINTENANCE	
Maintenance Superintendent	1
Foremen	2
Mechanical Tradesmen	6
Electrical Tradesmen	2
Instrumentation Tradesmen	2
Vehicle Maintenance Men	1
Misc. Trades & Labourers	4
Storekeeper	1
Subtotal	19
OPERATIONS	
Incinerator	
Supervisor	1
Production Engineer	1

TABLE 5.6

EMPLOYMENT LEVELS (Cont'd)

150 000 t/a CAPACITY

Category	Total
OPERATIONS Incinerator (Cont'd)	
Shift Foremen	4
Incinerator Operator	4
Boiler House Personnel	4
Flue Gas System Operators	4
Crane Operators	4
Labourers	2
Subtotal	24
PHYS/CHEM	
Supervisor	1
Production Engineer	1
Shift Foremen	2
Chemical Operators	8
Subtotal	12
SOLIDIFICATION	
Operators & Labourers	8
Subtotal	8
LANDFILL	
Shift Supervisor	1
Equipment Operators	1
Labourers	6
Subtotal	8
OPERATIONS Tank Farm/Pumping	
Incinerator Tank Personnel	4
Phys/Chem Tank Personnel	
Subtotal	4

TABLE 5.6

EMPLOYMENT LEVELS (Cont'd)

150 000 t/a CAPACITY

Category	Total
SERVICES	
Supervisor	1
Truck Receiving Personnel	4
Drum Handling Personnel	7
Truck Wash Operators	2
Chemicals & Miscellaneous Storage Personnel	1
Utilities Operators	8
Yard Maintenance	2
Subtotal	25
SUBTOTAL OPERATIONS	81
LABORATORY	
Physical/Chemical Lab	
Supervisor	1
Process Development Chemist	1
Process Development Technician	3
Main Lab	
Supervisor	1
Process Chemist	1
Process Technicians	3
Analytical Chemist	1
Analytical Technicians	3
Subtotal	14
TOTAL	151

TABLE 5.7

SUMMARY OF SERVICES TO SITE

Service	Routings Used for Planning Purposes
Surface Water Drainage Discharge	On-site drainage to Welland River via sewer. 498 950 t/a. (Perimeter drainage to existing drainage system.)
Sanitary Sewage	Treated on-site by packaged Activated Sludge Treatment Plant and discharged with surface drainage. (Included in surface drainage.)
Water Supply (Raw Water)	From Welland River. Treated on-site for all requirements including potable water. 16 450 t/a.
Natural Gas	From Vineland via pipeline. 163×10^{12} J/h.
Electric Power	From Ontario Hydro. Install line alongside of Silverdale Road. 115 kV
Telephone	From Bell line on Schram Road. 10 Lines

CHAPTER 6

PROJECT EXECUTION

6.1 PROJECT PLANNING AND MANAGEMENT

6.1.1 ENGINEERING

The proposed organization of Monenco Limited's engineering, procurement and construction management team during the execution phase is shown on figure 6.1. It is headed by a Project Manager who is directly responsible to OWMC's Project Manager for all aspects of the work. Standard project procedures require that all correspondence and decisions pass through this direct line of communication.

The major Monenco responsibilities of design, engineering, procurement and site construction management will be supervised by individual managers responsible to Monenco's Project Manager. This technical management team for the project will be augmented by a project services manager, responsible to Monenco's Project Manager for scheduling and cost control.

In the design areas, input will also be provided by sub-consultants having specialized knowledge and experience, as follows:

Incineration

- Environmental Elements Corporation, Baltimore, Maryland, USA,
- Von Roll, Zurich, Switzerland, and
- Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany.

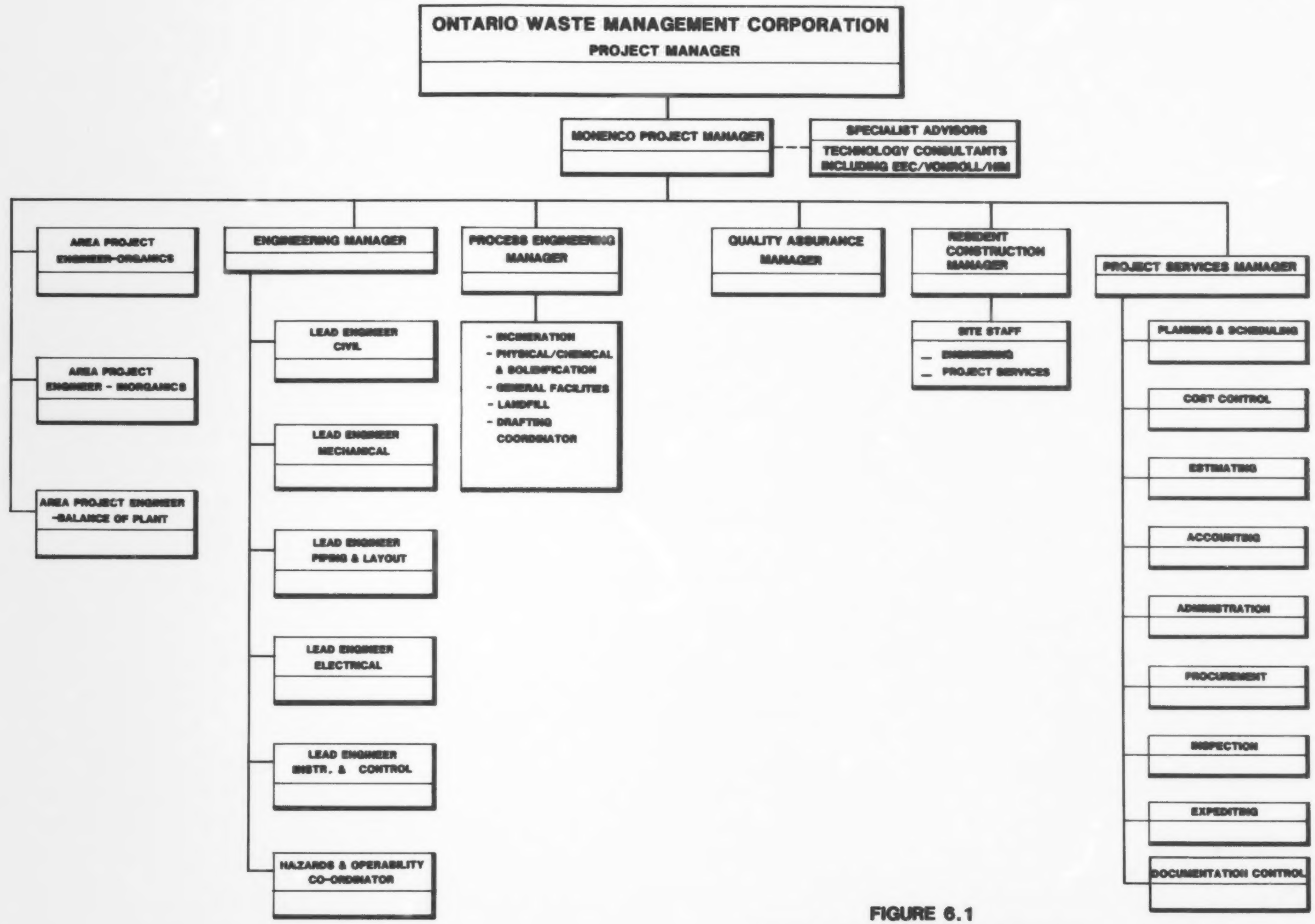

ONTARIO WASTE MANAGEMENT CORPORATION
PROJECT MANAGER
MONENCO PROJECT MANAGER
SPECIALIST ADVISORS
TECHNOLOGY CONSULTANTS INCLUDING EEC/VONROLL/HIM
AREA PROJECT ENGINEER-ORGANICS
AREA PROJECT ENGINEER - INORGANICS
AREA PROJECT ENGINEER -BALANCE OF PLANT
ENGINEERING MANAGER
LEAD ENGINEER CIVIL
LEAD ENGINEER MECHANICAL
LEAD ENGINEER PIPING & LAYOUT
LEAD ENGINEER ELECTRICAL
LEAD ENGINEER INSTR. & CONTROL
HAZARDS & OPERABILITY CO-ORDINATOR
PROCESS ENGINEERING MANAGER
- INCINERATION
- PHYSICAL/CHEMICAL & SOLIDIFICATION
- GENERAL FACILITIES
- LANDFILL
- DRAFTING COORDINATOR
QUALITY ASSURANCE MANAGER
RESIDENT CONSTRUCTION MANAGER
SITE STAFF
_ ENGINEERING
_ PROJECT SERVICES
PROJECT SERVICES MANAGER
PLANNING & SCHEDULING
COST CONTROL
ESTIMATING
ACCOUNTING
ADMINISTRATION
PROCUREMENT
INSPECTION
EXPEDITING
DOCUMENTATION CONTROL

FIGURE 6.1
ONTARIO WASTE MANAGEMENT CORPORATION
TREATMENT FACILITY
PROPOSED PROJECT ORGANIZATION CHART
EXECUTION PHASE

Physical/Chemical Treatment

- Environmental Elements Corporation, Baltimore, Maryland, USA, and
- Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany.

Solidification

- J. R. Conner Technologies, Atlanta, Georgia, USA.

Engineered Landfill

- M. M. Dillon Limited, Toronto, Ontario.

General Facilities

- Environmental Elements Corporation, Baltimore, Maryland, USA,
- Von Roll, Zurich, Switzerland,
- Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany, and
- Reed Stenhouse Limited, Toronto, Ontario.

Of these sub-consultants, J. R. Conner Technologies and M.M. Dillon Limited will be responsible to Monenco. The other consultants will be employed directly by OWMC under separate contracts and will be responsible for reviewing the design and operation of the Facility in respect of their particular specialty.

6.1.2 PROCUREMENT

Procurement services will be utilized during the execution phase to obtain prices and deliveries for major items of equipment, supply and erect subcontracts for buildings, roads etc. which will be built at the site and erection sub-contracts for the installation of equipment, piping, instrumentation and controls and electrical equipment, wiring etc. at the site.

In respect of equipment, bidders lists will be developed jointly with OWMC based on evaluation of contractor's previous experience, from Monenco's list of approved vendors and extent of Canadian content. Bid enquiries will contain a technical specification for the equipment and project-specific Instructions to Bidders, which will include a requirement for disclosure of percentage of Canadian content.

Standard procedures require that all correspondence be issued over the name of the Procurement Manager.

In the execution phase, detailed competitive bids will be solicited for the supply of equipment and for sub-contracts for buildings, roads, equipment installation etc. Comparative evaluations will be completed to ensure technical and commercial correctness, with the recommended selection submitted to OWMC for their approval.

Once a purchase order or sub-contract for the supply of equipment has been placed, Monenco's inspection and expediting services will monitor the material and manufacture of the product-to ensure compliance with specification, as well as delivery to meet schedule requirements. Administration of purchase orders and sub-contracts will be handled jointly by Project Services, for commercial and vendor liaison aspects, and Engineering for technical suitability. The specification and quoted performance of equipment may also be included in external reviews as described in Section 6.1.4.

6.1.3 CONSTRUCTION

Site construction will be supervised by Monenco's Site Construction Manager, who will be directly responsible to Monenco's Project Manager. The supervision of day-to-day activities on the site, will be monitored by area engineers and contract engineers, as required, to ensure a smooth and orderly progression of work by the contractors in accordance with the construction schedule.

Sub-contractors working on the site will also be under the authority of the Site Construction Manager, who will ensure maintenance of safety standards. Site construction will be scheduled to minimize interference between concurrent activities. Inspection services will be established to monitor compliance with the specification and drawings as well as the maintenance of quality control, including testing of materials and workmanship. As the site is within commuting distance of a large pool of construction labour, no construction camps are envisaged, but site offices will be established for the duration of construction and commissioning. Access to the site will also be controlled by fencing and designated entry points.

As the site erection of equipment and systems is completed, they will be functionally checked out and tested to verify operation, controllability and safety. Check-out and test records will be assembled to form the basis for an equipment/systems record data base; the records being countersigned by a designated Monenco representative.

On completion of utility systems as described in Section 3.7.5 (p. 198), in addition to check out and testing, these systems will be commissioned and placed in service to facilitate start-up of the Facility.

On completion of the whole Facility, test runs will be conducted on the process streams to confirm that the performance of the plant meets design parameters and safety standards.

6.1.4 QUALITY ASSURANCE

Quality Assurance consists of planned and systematic actions at all stages of a project to ensure that a facility conforms to project objectives, designs, standards, codes and regulations. Quality Control consists of the implementation of Quality Assurance actions to control and measure the elements of the project during design, procurement, fabrication and construction to verify that the criteria of reliability, operability and safety are met.

Monenco's corporate Quality Assurance program consists of three levels of checking and reviewing activities on the project. These will be:

- The Project Manager will establish project quality criteria, revise and approve the quality assurance plan and procedures, monitor the implementation of the plan and periodically audit the engineering to ensure procedural commitments are met.

- Internal reviews by Monenco's project team in accordance with the criteria for quality and safety, established by the Project Manager and written project procedures.

- External reviews of technical work that will be carried out and documented by other suitably qualified personnel within Monenco who are not working on this project. These reviews will be scheduled at significant milestones, or when requested, to evaluate the design against the criteria established for the project. These independent reviews will list the nature of deficiencies and completion date of corrective actions, which will then be reviewed as scheduled.

In addition to Monenco's own quality control, three key areas of the proposed facility will also be subjected to external review by sub-consultants designated by OWMC. These consultants have extensive experience of the design and operation of similar facilities in Europe.

- Environmental Elements Corporation, Baltimore, Maryland, USA.
  Von Roll, Zurich, Switzerland.
  Hessische Industriemüll GmbH (HIM), Wiesbaden, West Germany.

  - responsible for ensuring that their process design input for the incineration plant and general facilities is properly implemented in the execution phase, that detailed design and construction experience obtained from similar operating facilities is incorporated into Monenco's design and that related suppliers meet their criteria.

- Environmental Elements Corporation, Baltimore, Maryland, USA.
  Hessisch Industriemüll GmbH (HIM), Wiesbaden, West Germany.

  - responsible for reviewing the design of the physical/chemical treatment plant from an operational perspective.

- Reed Stenhouse Limited, Toronto, Ontario
    - responsible for loss control guidelines in the physical layout of the Facility and the fire protection systems.

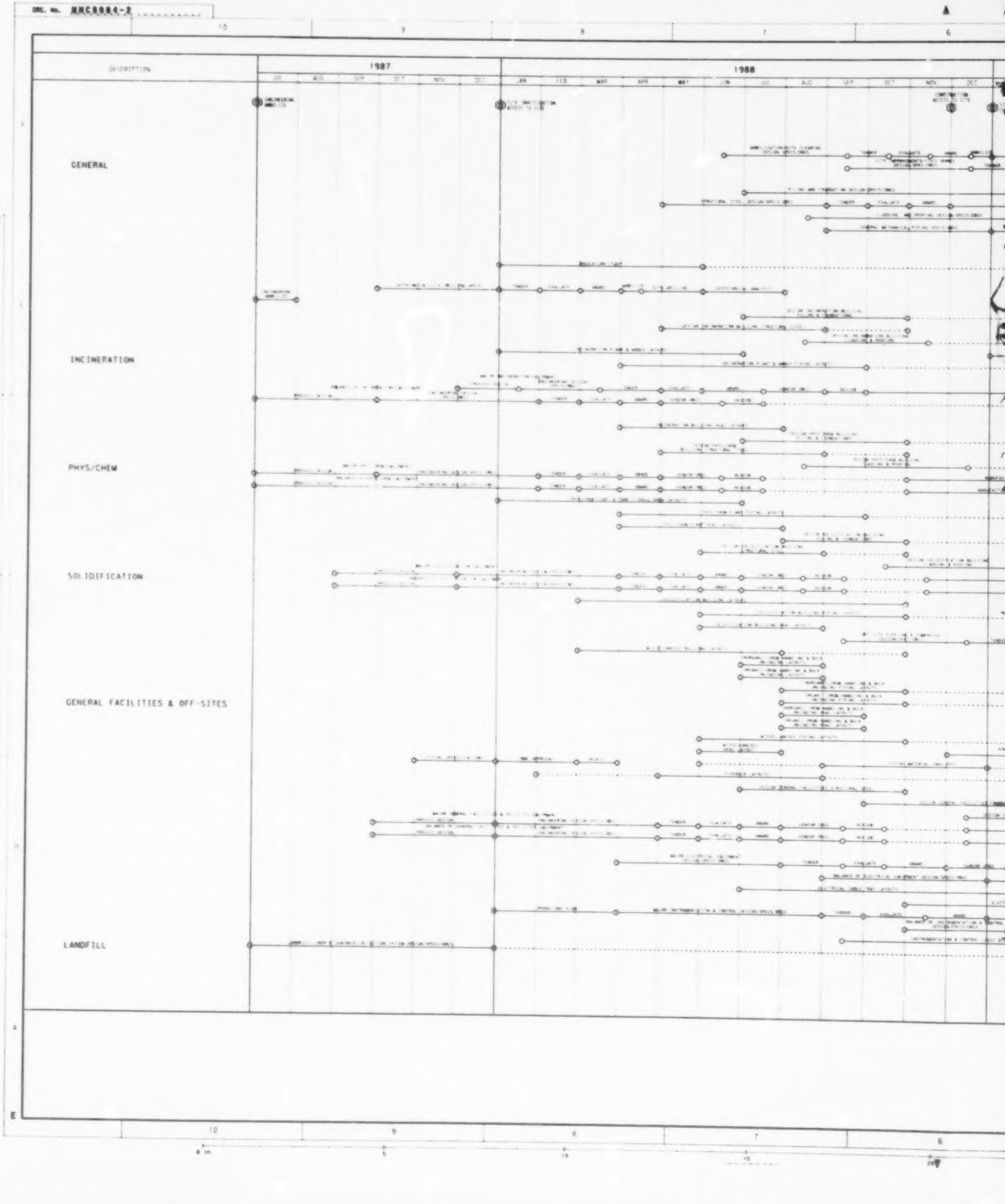
6.2 SCHEDULE

The proposed schedule covering design, procurement and construction is shown in Figure 6.2.

Detailed design will start in Month 1 with construction estimated to start in Month 18 and mechanical completion by Month 36.

For the purposes of this report, the schedule has been compiled in the form of a bar chart showing the major activities. Quoted delivery periods for major equipment items have been used in gauging order placement dates to suit the sequence of construction on site. Dependent activities, where one item must either be placed on its foundations or completed prior to the commencement of another activity, are also indicated.

Prior to the start of the execution phase, the schedule will be updated in to the form of a computerized Critical Path Method (CPM) network, which will be used to monitor progress. Monthly summaries of all activities will be generated showing the actual position against the schedule to highlight where remedial action is required. The CPM schedule, therefore, becomes a key management tool in ensuring the timely completion of the Facility.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CONSTRUCTION ACCESS TO SITE
GENERAL
MOBILIZATION/SITE CLEARING DESIGN SPECS/DWGS
TENDER
EVALUATE
AWARD
SITE IMPROVEMENTS/CIVIL WORKS DESIGN SPECS/DWGS
STRUCTURAL STEEL DESIGN SPECS/DWGS
SIDING AND ROOFING DESIGN SPECS/DWGS
GENERAL MECHANICAL/PIPING SPECS/DWGS
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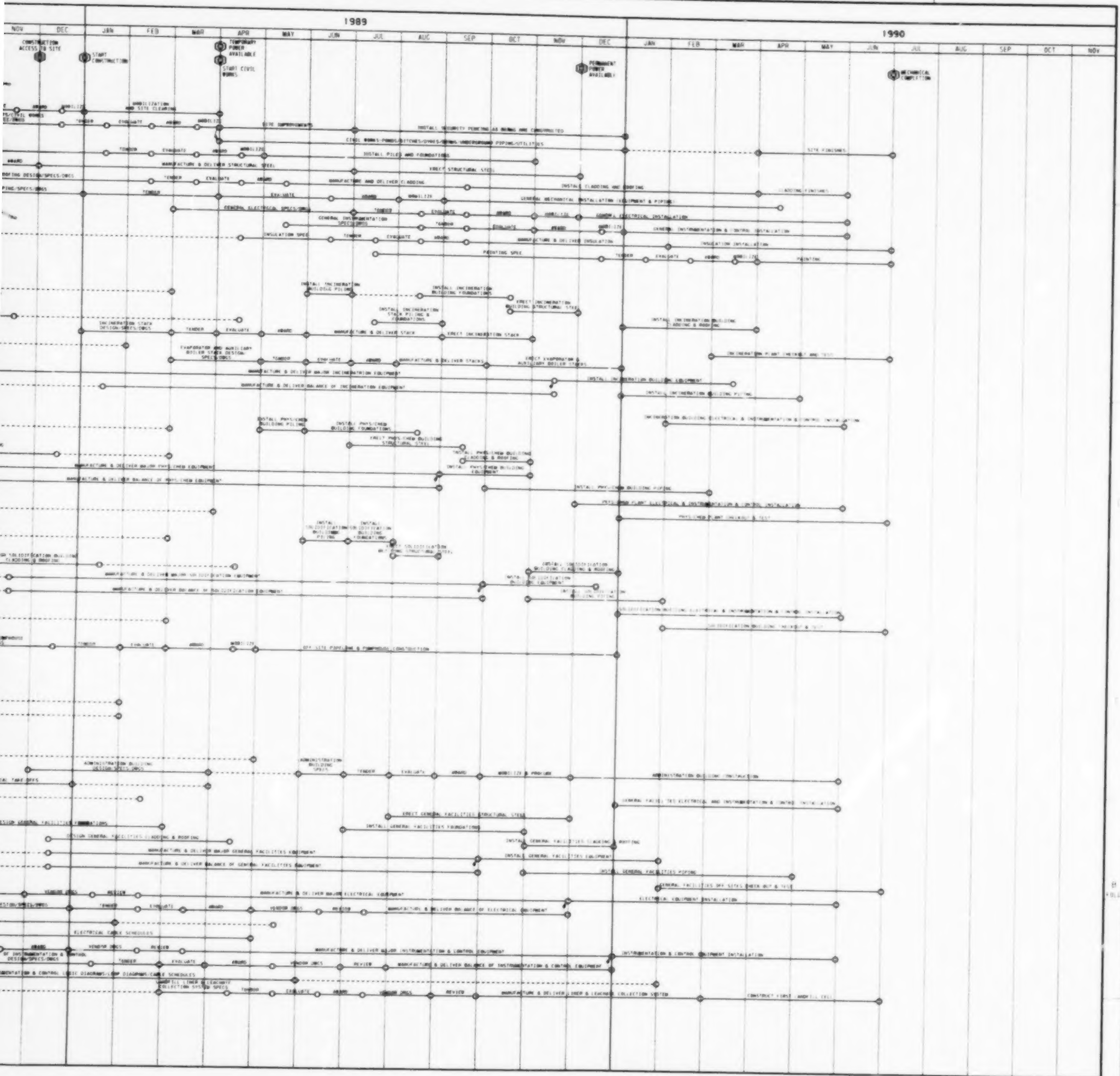

FIGURE 6.2

PROPOSED SCHEDULE

6.3 COSTS

Capital and operating cost estimates will be documented in the formal environmental assessment submission.

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APPENDIX A

WASTE QUANTITIES AND CHARACTERISTICS

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
1. Organic Sludge & still bottoms	247	Halogenated Still Bottoms	Spent Solvent or Waste Oil Recovery	265	265	-	-	-	-	
	248	Non-Halogenated Still Bottoms	Solvent Recovery Operations	1 060	353	707(W)	-	-	-	
	252	Solid or Sludge Tannery Wastes	Leather Shavings with Chrome	2 655	-	2 655	-	-	-	Mostly dry, solid leather dust contains Cr.
	257	Phenolic Wastes	Phenolic Oil, Toluene Diisocyanide Residue	833	-	-	883*	-	-	High water content, to Phys/Chem for initial processing
	261	Polymeric Resin	Polyester, Urethane, etc.	2 650	-	2 650	-	-	-	
	263	Other Polymeric Wastes	Kettle Bottoms, Thermoplastic Resins	1 766	565	618	583*	-	-	Approx 33% to Phys/Chem for initial processing
	446	Degreasing Sludge	Grease & Oily Soil Containing Trichloroethane(TCE)	883	883	-	-	-	-	
	523	Tank Bottom Sediments		883	883	883(W)	-	-	-	Contain water
	529	Explosive Wastes		0	-	-	-	-	-	
				11 045	2 066	7 513	1 466			
2. Solvent and Organic Solution	211	Halogenated Solvents with Heavy Metals	Methylene Chloride, 1,1,1 Trichloroethylene Used for Metal Cleaning	618	618	-	-	-	-	
	212	Halogenated Solvents with Other Metals	Surface Cleaning and Degreasing Solvents	88	88	-	-	-	-	
	213	Other Halogenated Solvents	Freon with Other Solvents Used in Chemical Processing	441	441	-	-	-	-	

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
	214	Non-Halogenated Solvents with Heavy Metals	Toluene, Benzene, Xylene Contaminated with Catalysts	530	530	-	-	-	-	
	215	Non-Halogenated Solvents with Other Metals	Acetone, Methylisobutylketone (MIBK) used in Paint and Varnish Formulation	265	265	-	-	-	-	
	216	Other Non-Halogenated Solvents	Methylethylketone and Other Solvents Contaminated with Dirt	265	265	-	-	-	-	
	217	Unspecified Solvents	Alcohols and Mixtures of Solvents	883	883	-	-	-	-	
	221	Organic Liquids with Metals and Halogens	Dyes	44	44	-	-	-	-	
	222	Organic Liquids with Halogens Only	Chloroform, Carbon Tetrachloride	4	4	-	-	-	-	
	223	Organic Liquids with Metals Only	Nickelcarbonyl, Methyl Mercury	18	18	-	-	-	-	
	224	Other Organic Liquids	Creosote & Other Poly Aromatic Hydrocarbons	176	176	-	-	-	-	
				3 332	3 332					
3. Oil & Grease	281	Waste Oil & Mixed Oil	Used Automotive Oil, Hydraulic Oil, Cutting Oil - May Contain Solvents or Metals	883	883	-	-	-	-	Stored in drums, maybe shipped in bulk
4. Oil & Water	283	Oily Mud, Sediment & Water	Crude Oil Tanker Cleaner	3 533	2 650	883(W)	-	-	-	Contains some water, assume 75% is pumpable
5. Organic & Oily Residues	264	Thermoset Wastes	Urea-Formaldehyde & Thermoset Wastes	9	9	-	-	-	-	

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
	282	Oily Tank Bottoms	Crude Oil or Sludge from Storage	442	305	88(W)	49*	-	-	Approx 11% to Phys/Chem for initial processing
	284	Oily Acidic Solids	Solids from Emulsion Breaking and Re-Refining	1 766	-	1 766(W)	-	-	-	Oil/grease, grit stored in tanks
	285	Oily Alkaline Solids	Refining Solids	9	-	-	9*	-	-	To Phys/Chem for initial processing
	286	Oil/Water Separator Sludge	Oil Cooled Heavy Inorganics	265	203	-	62*	-	-	Approx 25% to Phys/Chem for initial processing
	288	Oily Wastes with Heavy Metal Contaminants	Steel Rolling Mill Sludges & Mill Scale	883	353	530(W)	-	-	-	Non-pumpable: sludge/paste & water stored in drums & bins
	289	Oily Wastes with Water	Emulsions, Cleanup Water from Garages, Cooling Waters	2 650	530	-	2 120*	-	-	High water content, assume 20% direct to incinerator
	447	Tetraethyl Lead Sludge	Tank Bottoms	4	-	4(W)	-	-	-	
				6 028	1 400	2 388	2 240			
6. Heavy Metal Solutions & Residuals	111	Acidic Solution with Heavy Metals	Pickle Liquor Rinse Water	8 455	-	-	8 455	-	-	pH 1 or 2, solid approx 4%
	112	Acidic Solution with Other Metals & Non-Metals	Demineralizer Regenerent	4 228	-	-	4 228	-	-	pH 1

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
	113	Other Acidic Solutions	Boiler Stack Scrubber Water with Dilute Carbonic Acid (H_2CO_3)	3 171	-	-	3 171	-	-	pH 1, 2
	121	Alkaline Solution with Heavy Metals	Rinse Waters from Surface Cleaning of Metals	10 569	-	-	10 569	-	-	pH 11, 12
	122	Alkaline Solution with Other Metals	Demineralizer Regenerent	528	-	-	528	-	-	Some acid, pH=13?
	123	Other Alkaline Solutions	Cleanup Water from Lime or Cement Kiln	3 910	-	-	3 910	-	-	pH 12, 13 contains toluene & other organic, mercapton
	131	Metal Finishing Solutions, Acid	Ammonia Based, Containing Copper, Tin, Lead or Cadmium	1 585	-	-	1 585	-	-	pH 1-3, contains heavy metals
	132	Metal Finishing Solutions, Alkaline	Contains Strong Complexing Agent and Copper, Tin, Lead and/or Cadmium	528	-	-	528	-	-	pH 11, 12 contain heavy metals & organics
	133	Spent Pickle Liquor from Ferrous and Non-Ferrous Metals	Strong Acids with Iron, Fluoride, Hydrochloric Acid (HCl), Sulfuric Acid (H_2SO_4), Nitric Acid (HNO_1)	2 114	-	-	2 114	-	-	pH=1
	141	Aqueous Solutions with Heavy Metals	Cleaning Solutions from Tanks, Trucks, or Railroad Tankers	10 569	-	-	10 569	-	-	pH=7, contains oil & grease
	142	Aqueous Solutions with Other Metals	Rinse Water from Heat Treating Salt Baths, Contains Barium, Aluminum	7 398	-	-	7 398	-	-	No charact. data

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFI-CATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
	143	**Aqueous Solutions with Reactive Anions**	Bleaching Solutions Containing Sulfite, Chlorite, Fluoride, Bromate	2 642	-	-	2 642	-	-	pH=7, contain toluene S and phenols
	244	**Photochemical Waste**	Most Solutions Non-Toxic Except those with Silver	528	-	-	528	-	-	pH=3
	251	**Tannery Wastes - Liquid**	Solutions with Hexavelent Chromium	2 114	-	-	2 114	-	-	pH=9, contain Cr, NaCl
	431	**Heavy Metal Sludge**	Similar to that in 111, 113,121,123,132,133,141	15 853	-	-	3 805	-	12 048	pH 2-12
	433	**Other Metal Sludges**	Ferric Chloride, Aluminum Oxide, etc.	2 114	-	-	2 114	-	-	pH 2-12, one item has high sulphonic acid
	445	**Plating or Metal Finishing Sludge**	Derived Mostly from 131, 132,133	2 114	-	-	740	-	1 374	pH 8-10
	523	**Tank Bottom Sediments**		1 057	-	-	1 057	-	-	pH 7 some of UCD-523 allocated to group 1
				79 477			66 055		13 422	
7. Misc Chemical & Products	145	**Brine**	Salt Solutions After Neutralization or Chlor/Alkali Production	11	-	-	11	-	-	
	152	**Inorganic Solid Chemicals**	Aged or Off-Spec. Chemicals incl. Lime, Caustic Soda and Partial Containers of Laboratory Size	2 114	-	-	-	2 114	-	
	243	**Pharmaceuticals & Wastes**	Off-Spec. Drugs, Cleanup Waters, etc., includes Items such as Vitamins	177	62	115(W/DR)	-	-	-	

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
	245	Off-spec or Aged Organics	Can include Solids or Liquids. Generally in Containers.	442	-	442(W/DR)	-	-	-	Sludge, paste
	416	Ink Sludge	Sludge Could Contain Solvents & Lead, Cesium, Chromium	177	62	-	115*	-	-	Approx. 65% to Phys/Chem for initial treatment
	513	Laboratory Waste Chemicals	Partially Full Small Containers	177	-	177(W/DR)	-	-	-	
				3 098	124	734	126	2 114		
8. Paints & Org. Residuals	254	Adhesives or Glue	Waste Glues Mostly Aqueous. Some with Phenols.	442	221	221(W)	-	-	-	
	258	Waste Tar & Residues		1 943	-	1 943	-	-	-	Shipped in bulk, mostly tar/asphalt oil/grease, CaCO3 paper
	262	Latex Wastes	Cleanup Water, Paint, Latex & Acrylic Resins	442	-	150(W)	292*	-	-	Approx. 66% to Phys/Chem for initial processing
	454	Paint Sludge	Drum Bottoms, Spills, Cleanup, etc.	1 766	411	1 325(W)	-	-	-	
	455	Paint Sludge Without Heavy Metals	Mostly Latex	442	88	354(W/DR)	-	-	-	
				5 035	750	3 993	292			
9. Aqueous Solution with Organics	225	Aqueous Solution with Non-Halogenated Residues Less Than 10%	Laboratory Mixtures	1 325	141	-	1 184*	-	-	Approx. 89% to Phys/Chem for initial processing

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

					FORM OF WASTE AND TREATMENT PROCESS					
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFI-CATION INORGANIC	
OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	REMARKS
	226	Aqueous Solutions with Halogenated Residues Less Than 10%	Waste or Rinse Waters After Degreasing	9	9	-	-	-	-	
	227	Aqueous Solution with Non-Halogenated Organic Residue Greater Than 10%	Laboratory Mixtures	442	442	-	-	-	-	
	228	Aqueous Solution with Halogenated Organic Residue Greater Than 10%	Wash or Rinse Waters after Degreasing	9	9	-	-	-	-	
				1 785	601		1 184			
10. Anion Complexes	146	Solutions Containing Cyanide	Plating Baths	634	-	-	634	-	-	pH 12
	147	Solutions Containing Sulfides	Plating Baths	11	-	-	11	-	-	No characteristic data
	444	Cyanide Bearing Sludge	Pot Liners from Aluminum Reduction & Scrubber Sludge from Blast Furnace	422	-	-	211	211	-	Contain CN, Cd
				1 067			856	211		
11. Sludges & Inorganic Residuals	151	Inorganic Solids	Foundary Sand with Phenolics	10 569	-	-	-	-	10 569	Contain heavy metal, organics, form unknown
	165	Spent Catalyst	Maybe Carbon or Metal	211	-	-	-	-	211	Heavy metals, hydrocarbons
	167	Other Inorganic Waste	Ash & Construction Residue	3 171	-	-	-	-	3 171	Heavy metals, form unknown
	417	Alum & Gypsum Sludges	Waste Water Phosphate, Removal Sludge	105	-	-	-	-	105	

WASTE QUANTITY BASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	FORM OF WASTE AND TREATMENT PROCESS					REMARKS
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
					LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	
	441	Lime Sludges	From Treatment of Acids & Similar to 431 & Derived from 111,113,121,123,131, 132,133,141	15 853	-	-	12 682	-	3 171	Sludge, may only need dewatering in Phys/Chem
	443	Sulfur Sludge	Desulfurization of Flue Gas Non-reactive but Very Low Bearing Strength	11	-	-	-	-	11	Note: Initial treatment process of UCD 151,165, 167,518 to be reviewed
	518	Dust Collector Wastes	Dry Lime from Dust Control Baghouse	2 114	-	-	-	-	2 114	Heavy metals, phenolic resin
				32 034			12 682		19 352	
12. Pesticide & Herbicide	241	Pesticides & Wastes	Partial Containers, Tank Washings, Off-spec Product, etc.	132	132	-	-	-	-	
	532	Equipment and/or Containers Contaminated with Pesticides	Empty Pesticide Cans	44	-	44(DR)	-	-	-	
				176	132	44				
13. PCB Wastes	242	PCB Oils & High Strength (over 500 ppm) Liquids	From Transformers & Capacitors	35	-	35(DR)	-	-	-	
14. Clean Up Residuals	512	Spill Cleanup	Oil/Soil Mixture	618	-	618(DR)	-	-	-	Primarily soil contaminated with oil
	521	Spent Cartridge Filters	Air Cleaning Filters on Ventilation System	618	-	618(DR)	-	-	-	
	528	Pathogenic Wastes	Used Bandages, Dressings	618	-	618(DR)	-	-	-	

WASTE QUANTITY EASIS (BASED ON WASTE PROFILE NOVEMBER 6, 1984)

OWMC WASTE GROUP	UCD	DESCRIPTION	TYPICAL WASTES	QUANTITY t/a	FORM OF WASTE AND TREATMENT PROCESS					REMARKS
					INCINERATION PRIMARILY ORGANIC		PHYS/CHEM PRIMARILY INORGANIC		SOLIDIFICATION INORGANIC	
					LIQUIDS & SLUDGES	NON-PUMPABLES	LIQUIDS & SLUDGES	NON-PUMPABLES	NON-PUMPABLES	
	531	Contaminated Rags	Cleanup Materials	618	-	618(DR)	-	-	-	
				2 472	-	2 472				
			TOTALS	150 000	11 938	18 062	84 901	2 325	32 774	
		Non-pumpables to incinerator in drums or in wet form (W-Wet; DR-Drum)				10 196				
		10% of wastes denoted by * to be redirected to incinerator, Total			530	<-----------	5 297*			

APPENDIX B

ENVIRONMENTAL MONITORING PROGRAM

TABLE B.1

ENVIRONMENTAL MONITORING PROGRAM
AREA: GENERAL

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Clean storm water pond.	Applicable general water quality criteria - per regulations.	To ensure water meets regulatory standards before discharge to public water course.	Prior to discharge.	Spot samples for Laboratory analysis.
Potentially contaminated storm water pond.	as above	To ensure water meets regulatory standards before discharge to public water course.	Prior to discharge.	Spot samples for Laboratory analysis.
Sanitary sewage treatment plant	As per applicable regulations.	To ensure effluent meets regulatory standards before discharge to public water course.	Daily	Spot samples for Laboratory analysis.
Truck wash vent air from scrubber/adsorber exhaust.	(1) Total organic carbon.	To verify performance of adsorber.	occasional	portable instrument
	(2) Pertinent Reg 308 contaminants .	To verify that exhaust air meets Reg 308 requirements.	quarterly	Spot sample for full laboratory analysis.
Ambient air from various locations within plant fence.	Pertinent Reg 308 contaminants	To check for fugitive emissions.	- spot sampling - continuous sampling	- laboratory analysi - field monitors

TABLE B.2

ENVIRONMENTAL MONITORING PROGRAM
AREA: ORGANIC WASTE HANDLING

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Organic tank truck unloading area ventilation adsorber exhaust.	(1) Total organic carbon.	To verify performance of adsorber.	occasional	portable instrument
	(2) Pertinent Reg 308 contaminants.	To verify that exhaust air meets Reg 308 requirements.	quarterly	Spot sample for full laboratory analysis.
Organic tank truck unloading area underground pit area.	(1) Explosive gases. Oxygen.	Operator access.	As required before entry into area.	Portable instruments
	(2) Indicator chemicals depending upon nature of recent wastes handled.	To verify performance of ventilation system	occasional	as above
Organic drum storage and handling building ventilation scrubber/ adsorber exhaust.	(1) Total organic carbon.	To verify performance of adsorber.	occasional	portable instruments
	(2) Pertinent Reg 308 contaminants.	To verify that exhaust air meets Reg 308 contaminants.	quarterly	Spot sample for full laboratory analysis.

TABLE B.2

ENVIRONMENTAL MONITORING PROGRAM
AREA: ORGANIC WASTE HANDLING (Cont'd)

LOCATION	CONTAMINANT		OBJECTIVE	FREQUENCY	METHOD
Organic drum storage and handling building operating floor.	(1) Benzene Acrylonitrile Isocyanates Vinyl chloride etc.	according to nature of wastes being handled.	To verify that workers environment does not exceed MOE regulations.	Continuous during working shift.	Personal monitors.
	(2) Designated substances as per applicable regulations.		as above	to be determined	Full spectrum laboratory analysis.

TABLE B.3

ENVIRONMENTAL MONITORING PROGRAM
AREA: INORGANIC WASTE HANDLING

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Inorganic tank truck unloading area ventilation adsorber exhaust.	(1) H_2S HCN HCl SO_x NO_x depending upon nature of waste being unloaded.	To verify performance of scrubber/adsorber	occasional	portable instruments and laboratory analyses.
	(2) Pertinent Reg 308 contaminants	To verify that exhaust air meets Reg 308 requirements.	quarterly	Spot sample for full laboratory analysis.
Inorganic tank truck unloading area underground pit area.	(1) Explosive gases. Oxygen.	Operator access	As required before entry into area.	Portable instruments
	(2) Toxic gases depending upon nature of recent wastes handled.	To verify performance of ventilation system.	occasional	as above
Inorganic drum storage and handling area ventilation scrubber/adsorber exhaust.	(1) H_2S HCN HCl SO_x NO_x depending upon nature of waste being unloaded.	To verify performance of scrubber/adsorber	occasional	portable instruments and laboratory analysis.
	(2) Pertinent Reg 308 contaminants.	To verify that exhaust air meets Reg 308 requirements.	quarterly	Spot sample for full laboratory analysis.

TABLE B.3

ENVIRONMENTAL MONITORING PROGRAM
AREA: INORGANIC WASTE HANDLING (Cont'd)

LOCATION		CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Inorganic drum storage and handling building operating floor.	(1)	Designated chemicals according to nature of wastes being handled. eg. Mercury and Asbestos	To verify that workers environment does not exceed MOE regulations.	Continuous during working shift.	Personal monitor and portable instruments.
	(2)	Designated substances as per applicable regulations.	as above	to be determined	Full spectrum laboratory analysis.

TABLE B.4

ENVIRONMENTAL MONITORING PROGRAM
AREA: INCINERATOR TANK FARM

LOCATION		CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Standby adsorber exhaust. (During shutdown periods only.)	(1)	Total organic carbon.	To verify performance of adsorber.	occasional	portable instrument
(During incinerator shutdown periods only.)	(2)	Pertinent Reg 308 contaminants.	To verify that exhaust air meets Reg 308 requirements.	Once during period of operation.	Spot sample for full laboratory analysis.

TABLE B.5

ENVIRONMENTAL MONITORING PROGRAM
AREA: INCINERATION PLANT

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Stack	(1) o carbon monoxide	Performance monitoring of major contaminants, and general confirmation with Reg 308.	Continuous	on line monitor
	o total organic carbon		Continuous	on line monitor
	o sulphur-dioxide		Continuous	on line monitor
	o hydrogen chloride		Continuous	on line monitor
	o particulate opacity		Continuous	on line monitor
	o nitrogen oxides		Continuous	on line monitor
	o heavy metals		daily composite sample	laboratory analysis (approx method)
	(2) In accordance with Reg 308.	To verify that incinerator effluent is of acceptable quality with respect to Reg 308.	quarterly	full laboratory analysis

TABLE B.6

ENVIRONMENTAL MONITORING PROGRAM
AREA: PHYSICAL/CHEMICAL TREATMENT PLANT

LOCATION		CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Building ventilation air scrubber/adsorber	(1)	H_2S HCN Total organic carbon (TOC) depending upon nature of wastes processed	To verify performance of scrubber/adsorber	occasional	portable instruments and laboratory analyses.
	(2)	Pertinent Reg 308 contaminants	To verify that exhaust air meets Reg 308 requirements.	quarterly	Spot sample for full laboratory analysis.
Scrubber/adsorber exhaust from aqueous organic treatment units.		TOC	To verify that exhaust stream meets Reg. 308 requirements.	composite sample for each batch.	Laboratory analysis.
Scrubber/adsorber exhaust from reactors.		H_2S HCN TOC depending upon nature of wastes processed.	To verify that exhaust stream meets Reg. 308 requirements.	composite sample for each batch.	Laboratory analysis.
Evaporator vent stack.		Particulates TOC Total halides	To verify that exhaust stream meets Reg. 308 requirements.	quarterly	Spot sample for laboratory analysis
Evaporator feed.		to be determined	performance verification	daily	as above

TABLE B.6

ENVIRONMENTAL MONITORING PROGRAM
AREA: PHYSICAL/CHEMICAL TREATMENT PLANT (Cont'd)

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Enclosed operating area.	(1) H_2S HCN according to nature of wastes being handled.	To verify that workers environment does not exceed MOE regulations.	Continuous during working shift.	Personal monitor and portable instruments.
	(2) Designated substances as per applicable regulations	as above	to be determined	Full spectrum laboratory analysis.

TABLE B.7

ENVIRONMENTAL MONITORING PROGRAM
AREA: SOLIDIFICATION PLANT

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Exhaust from cement silo bag houses	particulates	To verify that exhaust air meets Reg. 308 requirements.	Periodic sample during cement unloading.	Spot sample for laboratory analysis.
Exhaust from building ventilation system.	particulates	as above	Quarterly	as above
Exhaust from other ventilation systems.	particulates	as above	As necessary.	as above
Exhaust from bunker area	particulates	as above	Quarterly	as above
Exhaust from mixers.	particulates	as above	Periodic	as above

TABLE B.8

ENVIRONMENTAL MONITORING PROGRAM
AREA: LANDFILL AREA

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Perimeter Surface Drainage - uncontaminated system	Applicable general water quality criteria	- determine safe discharge - detention/retention	- minimum weekly, - development change - precipitation events - discharge events	Laboratory analysis.
Potentially contaminated Internal Surface Drainage and Leachate	Slate to be determined	- to determine safe discharge or treatment required.	- prior to release	- as above
Leachate Collection System	o as above.	- performance monitoring	- weekly	- as above
Cover Ground Water	o as above	- monitor shallow fracture zone pathway	- monthly	Field located instruments and laboratory analyses.
Perimeter and Deep Ground Water	Applicable general water quality criteria.	- monitor shallow fracture zone pathways - migration into clay - Bedrock Aquifer protection.	- monthly	- Field located instruments and laboratory analyses.

TABLE B.9

ENVIRONMENTAL MONITORING PROGRAM
AREA: CENTRAL OPERATING AREA

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Storage Areas - tank farms - drum storage and handling - interim storage - reagent storage	- slate to be determined.	- monitor for leaks and spills - site condition data file to identify changes from base line and provide remedial lead time	- variable - continuously for presence of fluids where containment should not fail	Field instruments, continuous monitors and laboratory analysis as applicable.
Monitoring points within and surrounding pads or diked areas	- slate to be determined.	- decommissioning planning	- weekly to monthly for water quality changes - weekly to monthly with dependance on location and dynamics of flow systems.	
Receiving Basins Sumps and Bunkers	- as above	- as above	- as above	- as above
Sewers - contaminated sewer lines - potentially contaminated sewer lines - catch basins - sump areas	- as above	- as above	- as above	Field instruments, laboratory analysis and continuous monitors as applicable.

TABLE B.9

ENVIRONMENTAL MONITORING PROGRAM
AREA: CENTRAL OPERATING AREA (Cont'd)

LOCATION	CONTAMINANT	OBJECTIVE	FREQUENCY	METHOD
Ponds - monitoring wells at varied depths to unfractured zone - on all sides but particularly down gradient - between and below double liners	- as above	- as above - effectiveness of dewatering/depressuring beneath liners.	- regularly (weekly to monthly)	Field instruments, laboratory analysis and continuous monitors as applicable.
General - regularly spaced throughout and surrounding COA - locations to fill gaps from other specific monitors. - dependent on contaminant dispersion characteristics	General water quality criteria plus a specific slate to be determined later.	- monitor for leaks and spills - site condition data file to identify changes from base line and provide remedial lead time - decommissioning planning	- regularly (weekly to monthly)	Field instruments, laboratory analysis and continuous monitors as applicable.

APPENDIX C

FACILITY CHARACTERISTICS INFORMATION

APPENDIX C.1

OFF-SITE TIE-INS

OWMC TREATMENT FACILITY

PAGE 1 OF 5

OFFSITE TIE-INS

150 000 t/a & 300 000 t/a PLANT CAPACITY

NOTES

1. REFER TO PROCESS BLOCK DIAGRAMS - 003000301 REV. A
   003000302 REV. A
   003000303 REV. A
   003000304 REV. A
   003000311 REV. A
   003000312 REV. A
   003000313 REV. A
2. FOR TRANSPORTATION ASSESSMENT THE 150 000 t/a TYPICAL OPERATION CAN BE USED.
3. FOR TRANSPORTATION ASSESSMENT THE 300 000 t/a TYPICAL OPERATION CAN BE USED.
4. FOR TYPICAL OPERATION FEED CHARACTERISTICS ESTIMATED BASED ON WASTE QUANTITY BASIS JAN.85(DERIVED FROM OWMC NOV.84 WASTE PROFILE) AND WASTE CHARACTERISATION DATA NOV.1984 TOTAL SOLIDS IN INORGANIC FEED-25.8% SOLIDS BALANCE APPROX. ONLY.
5. FOR HIGH EFFLUENT SCENARIO, TOTAL SOLIDS IN INORGANIC FEED ARE ASSUMED TO BE 10%. THIS SCENARIO GIVES A HIGH VENT RATE. SOLIDS BALANCE IS APPROX. ONLY.
6. FOR HIGH SOLIDIFIED WASTE SCENARIO, INORGANIC FEED IS ASSUMED TO HAVE 25.8% TOTAL SOLIDS AND HIGH Ca. IT IS ASSUMED THAT 80% OF THE EFFLUENT FROM PHYS/CHEM PLANT ORIGINATED FROM RAW WASTE WILL BE BYPASSED TO SOLIDIFICATION.
7. STEAM VENT COULD BE AS HIGH AS 25.9 t/h DURING DISPOSAL OF CONTAMINATED STORM WATER.

B	MAY/13/86	ENGINEERING INPUT TO ENVIRONMENTAL IMPACTS ASSESSMENT (PHASE 4B)	A.B	CN	-	YS
A	APR/30/86	PHASE 4B- ISSUED FOR OWMC COMMENTS	AOB	CN	-	YSC
REV	DATE	DESCRIPTION	BY	DFTG	CHK'D	APP'D

QS2:[170,100]OWMCSUM.DGN

OWMC TREATMENT FACILITY

OFFSITE TIE-INS

150 000 t/a & 300 000 t/a PLANT CAPACITY

NOTES

8. WASTE DELIVERIES FROM YEAR 1 TO 10 BASED ON THE FOLLOWING:

YEAR OF OPERATION	QUANTITY OF SPECIAL WASTE (t/a) TOTAL	ORGANIC	INORGANIC
1	50 000	20 000	30 000
2	70 000	20 000	50 000
3	105 000	25 000	80 000
4	130 000	30 000	100 000
5	150 000	30 000	120 000
6	180 000	36 000	144 000
7	210 000	42 000	168 000
8	240 000	48 000	192 000
9	270 000	54 000	216 000
10	300 000	60 000	240 000

9. WITH THE EXCEPTION OF REAGENTS & ADDITIVES, QUANTITIES FOR YEARS 11 TO 20 ARE THE SAME AS FOR YEAR 10. ADDITIVE QUANTITIES FOR YEARS 11 TO 20 MAY BE MARGINALLY HIGHER THAN THOSE PRESENTED FOR YEAR 10.

10. INCLUDES: UNCONTAMINATED STORM WATER FROM SITE AND TREATED DOMESTIC SEWAGE.

11. ASSUMES LANDFILL EXCAVATION USED FOR PERIMETER DYKES & BERMS.

B	MAY/13/86	ENGINEERING INPUT TO ENVIRONMENTAL IMPACTS ASSESSMENT (PHASE 4B)	AoB	CN	-	YSC
A	APR/30/86	PHASE 4B- ISSUED FOR OWMC COMMENTS	AOB	CN	-	YSC
REV	DATE	DESCRIPTION	BY	DFTG	CHK'D	APP'D

QS2:[170,100]OWMCSUM.DGN

OWMC TREATMENT FACILITY			OFFSITE TIE-INS 150 000t/a & 300 000t/a PLANT CAPACITY						PAGE 3 OF 5 REV B PREPARED BY: A.L.O'BRIEN DATE: MAY 13, 1986	
OFFSITE TIE-INS			150 000t/a FACILITY (YEAR 5)			300 000t/a FACILITY (YEAR 10)				
			TYPICAL OPERATION t/a	HIGH EFFLUENT SCENARIO t/a	HIGH SOLIDIFIED WASTE SCENARIO t/a	TYPICAL OPERATION t/a	HIGH EFFLUENT SCENARIO t/a	HIGH SOLIDIFIED WASTE SCENARIO t/a	BASIS NOTE 1	REMARKS
ROAD	WASTE DELIVERY									
	ORGANIC	-PUMPABLE WASTE	11 050	NOTE 2	NOTE 2	22 100	NOTE 3	NOTE 3	STREAM 11	TOTAL 30 000 t/a (STREAM 1)
		-NON PUMPABLE WASTE	7 870	NOTE 2	NOTE 2	15 740	NOTE 3	NOTE 3	STREAM 13	
		-DRUMS	11 080	NOTE 2	NOTE 2	22 160	NOTE 3	NOTE 3	STREAM 12	
	INORGANIC	-PUMPABLE WASTE	83 700	NOTE 2	NOTE 2	167 400	NOTE 3	NOTE 3	STREAM 26 & 8	TOTAL 120 000 t/a (STREAM 2 & 3)
		-NON PUMPABLE WASTE	35 100	NOTE 2	NOTE 2	70 200	NOTE 3	NOTE 3	STREAM 28 & 3	
		-DRUMS	1 200	NOTE 2	NOTE 2	2 400	NOTE 3	NOTE 3	STREAM 27	
	REAGENTS & ADDITIVES SUPPLY		-	-	-	-	-	-	STREAMS 4,5,6 7 & OTHERS	SEE SHEET 3
	GRANULAR MAT'L TO LANDFILL		7 100	3 500	11 700	13 900	6 900	23 000	STREAM 84	
	EARTH REMOVAL FROM LANDFILL		80 000	0	297 000	354 000	176 000	594 000	STREAM 85	1.75t/m^3 AFTER 15% BULKING
	NITROGEN SUPPLY		100(80x10^3 Nm^3/a)	100	100	200	200	200		
	SEWAGE SLUDGE TO DISPOSAL		50	50	50	100	100	100	STREAM 30	
PIPELINES	EFFLUENT TO WELLAND RIVER		498 950	498 950	498 950	503 100	503 100	503 100	STREAM 81	NOTE 10
	RAW WATER SUPPLY		16 450	16 450	57 750	34 500	32 900	123 850	STREAM 9	1.75t/m^3 AFTER 15% BULKING
	NATURAL GAS SUPPLY		163x10^{12}J/a	163x10^{12}J/a	163x10^{12}J/a	59x10^{12}J/a	59x10^{12}J/a	59x10^{12}J/a		ASSUMES USE OF NATRURAL GAS AS SUPPLEMENTARY FUEL
EMISSIONS TO ATMOSPHERE	INCINERATOR FLUE GAS STACK		517 900	517 900	517 900	1 035 800	1 035 800	1 035 800	STREAM 15	FOR CONTAMINANTS REFER TO "ESTIMATE OF GAS EMISSION FOR RISK ASSESSMENT"
	AUX BOILER FLUE GAS STACK		57 240			21 320				
	EVAPORATOR VENT STACK		4 600	48 200	0	0	78 500	0	STREAM 44 NORMAL CONDITION	FOR CONTAMINANTS REFER TO "ESTIMATE OF GAS EMISSION FOR RISK ASSESSMENT"
			72 300	115 900	26 400	66 100	146 200	0	ONE INCINERATOR IS DOWN-ABNORMAL CONDITION	NOTE 7
OTHER SERVICES	HYDRO		115 kV	115 kV	115 kV	115 kV	115 kV	115 kV		
	TELEPHONE		10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	10 LINES		

OWMC
TREATMENT FACILITY

OFFSITE TIE-INS

150 000t/a & 300 000t/a PLANT CAPACITY
REAGENTS & ADDITIVES

PAGE 4 OF 5 REV B
PREPARED BY: A.L.O'BRIEN
DATE: MAY 13,1986

	REAGENT & ADDITIVES	150 000t/a FACILITY (YEAR 5)			300 000t/a FACILITY (YEAR 10)			REMARKS
		TYPICAL OPERATION t/a	HIGH EFFLUENT SCENARIO t/a	HIGH SOLIDIFIED WASTE SCENARIO t/a	TYPICAL OPERATION t/a	HIGH EFFLUENT SCENARIO t/a	HIGH SOLIDIFIED WASTE SCENARIO t/a	
SOLIDIFIC'N PLANT	-CEMENT	12 240	4 730	24 890	24 480	9 460	49 580	
	-SODIUM SILICATE	1 300	500	5 250	2 600	1 000	10 500	
	-LIME	320	123	320	640	246	640	
	-CLAY	320	123	320	640	246	640	
	-FLY/ASH	320	123	320	640	246	640	
PHYS/CHEM PLANT	-CAUSTIC (50%)	5 810	NOTE 2	NOTE 2	11 620	NOTE 3	NOTE 3	
	-LIME	260	NOTE 2	NOTE 2	520	NOTE 3	NOTE 3	
	-SULPHURIC ACID (93%)	715	NOTE 2	NOTE 2	1 430	NOTE 3	NOTE 3	
	-FERRIC CHLORIDE (37%)	30	NOTE 2	NOTE 2	60	NOTE 3	NOTE 3	
	-SODIUM BISULPHITE (37%)	1 000	NOTE 2	NOTE 2	2 000	NOTE 3	NOTE 3	
	-SODIUM HYPOCHLORITE (10.8%)	1 000	NOTE 2	NOTE 2	2 000	NOTE 3	NOTE 3	
	-SODIUM HYDROSULPHIDE (45%)	20	NOTE 2	NOTE 2	40	NOTE 3	NOTE 3	
	-POLYELECTROLYTE	11	NOTE 2	NOTE 2	22	NOTE 3	NOTE 3	
	-FILTER AID	51	NOTE 2	NOTE 2	102	NOTE 3	NOTE 3	
	-ACTIVATED CARBON	200	NOTE 2	NOTE 2	400	NOTE 3	NOTE 3	
INCINERATION PLANT	-LIME	1 400	1 400	1 400	2 800	2 800	2 800	
	-CAUSTIC (50%)	1 300	1 300	1 300	2 600	2 600	2 600	
	-SULPHURIC ACID (93%)	16	16	16	32	32	32	
	-SALT	77	77	77	154	154	154	
	-SODIUM SULPHITE	1.5	1.5	1.5	3.0	3.0	3.0	
	-MORPHELINE	2.0	2.0	2.0	4..0	4.0	4.0	
	-TRI-SODIUM PHOSPHATE	0.5	0.5	0.5	1.0	1.0	1.0	
SOLIDIFIC'N PLANT (AT INCIN.)	-CEMENT	1 080	1 080	1 080	2 160	2 160	2 160	
OTHERS	-SODIUM HYPOCHLORITE (10%)	15.6	15.6	15.6	31.2	31.2	31.2	
	-ALUM	15.6	15.6	15.6	31.2	31.2	31.2	
	-POLYELECTROLYTE	0.1	0.1	0.1	0.2	0.2	0.2	
	-PULVERIZED CLAY	0.8	0.8	0.8	1.6	1.6	1.6	
	-CAUSTIC	570	570	570	1 140	1 140	1 140	

OWMC TREATMENT FACILITY

OFFSITE TIE-INS

150 000t/a & 300 000t/a PLANT CAPACITY (TYP OPERATION SUMMARY)

PAGE 5 OF 5 REV B
PREPARED BY: A.L.O'BRIEN
DATE: MAY 13,1986

OFFSITE TIE-INS			TONNES/ANNUM										REMARKS
			YEAR										
			1	2	3	4	5	6	7	8	9	10	
ROAD	WASTE DELIVERY (NOTE 8)												
	ORGANIC	-PUMPABLE WASTE	7 367	7 367	9 208	11 050	11 050	13 260	15 470	17 680	19 890	22 100	
		-NON PUMPABLE WASTE	5 247	5 247	6 558	7 870	7 870	9 444	11 018	12 592	14 166	15 740	
		-DRUMS	7 386	7 386	9 234	11 080	11 080	13 296	15 512	17 728	19 944	22 160	
	INORGANIC	-PUMPABLE WASTE	20 925	34 875	55 800	69 750	83 700	100 440	117 180	133 920	150 660	167 400	
		-NON PUMPABLE WASTE	8 775	14 625	23 400	29 250	35 100	42 120	49 140	56 160	63 180	70 200	
		-DRUMS	300	500	800	1 000	1 200	1 440	1 680	1 920	2 160	2 400	
	REAGENTS & ADDITIVES SUPPLY		-	-	-	-	-	-	-	-	-	-	FOR QUANTITIES REFER TO YEAR 5 & 10 ON SHT.3
	GRANULAR MATERIAL TO LANDFILL		2 300	3 300	4 900	6 100	7 100	8 400	9 800	11 200	12 600	13 900	
	EARTH REMOVAL FROM LANDFILL		0	0	0	0	80 000	213 000	249 000	283 000	321 000	354 000	NOTE 11
	NITROGEN SUPPLY		66	66	83	100	100	120	140	160	180	200	
	SEWAGE SLUDGE TO DISPOSAL		50	50	50	50	50	100	100	100	100	100	
PIPELINES	EFFLUENT TO WELLAND RIVER		498 950	498 950	498 950	498 950	498 950	503 100	503 100	503 100	503 100	503 100	NOTE 10
	RAW WATER SUPPLY		7 263	9 304	12 367	14 408	16 450	23 100	25 550	28 000	30 450	34 500	
	NATURAL GAS SUPPLY		60×10^{12} J/h	80×10^{12} J/h	117×10^{12} J/h	142×10^{12} J/h	163×10^{12} J/h	207×10^{12} J/h	170×10^{12} J/h	133×10^{12} J/h	96×10^{12} J/h	59×10^{12} J/h	ASSUMES USE OF NATURAL GAS AS SUPPLEMENTARY FUEL.
EMISSIONS TO ATMOSPHERE	INCINERATOR FLUE GAS STACK		345 267	345 267	431 583	517 900	517 900	621 480	725 060	828 640	932 220	1 035 800	
	AUX BOILER FLUE GAS STACK		21 070	28 093	41 086	49 866	57 240	72 691	59 698	46 705	33 712	21 320	
	EVAPORATOR VENT STACK		-	-	-	-	-	-	-	-	-	-	TYPICALLY VARIES FROM 3% TO 5% OF TOTAL PLANT FEED
OTHER SERVICES	HYDRO		115kV	115kV	115kV	115kV	115kV	115kV	115kV	115kV	115kV	115kV	
	TELEPHONE		10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	10 LINES	

150 000 t/a CAPACITY ← → 300 000 t/a PLANT CAPACITY

300 000 t/a PLANT CONSTRUCTION PHASE

APPENDIX C.2

FACILITY NOISE

INTRODUCTION

This appendix was prepared to provide the environmental assessment consultants with anticipated noise levels generated at the Facility. Noise sources are located both indoors and outdoors.

In general, the interior equipment will have the noise attenuated by the building walls. The process buildings will be of steel frame construction with insulated sandwich panel cladding which is sufficient for attenuating sound in most of the process areas. Noise from indoor equipment may, emanate through ventilation louvres and open doors, however this will not be a significant contribution to the noise impact of the Facility.

In certain areas of the plant, additional sound control measures may be required at the detailed design stage to ensure attenuation. These include:

- forced draft and induced draft fans in the incineration plant.

- crushers/shredders in the solidification plant.

- drum crushers in the organic and inorganic drum storage and handling buildings.

Since the equipment noise level that is of most concern to the general public is the noise generated by outdoor equipment, this document is limited to a description of outdoor noise sources.

The sources of outdoor noise are summarized in the attached Table C.2 which provides the following information:

- location of stationary and mobile noise sources (area descriptions are in accordance with Figure 3.2),

- number and type of normally operating pieces of stationary outdoor equipment and anticipated noise levels based on in-house and vendor information for each item,

- number and type of mobile equipment for landfill operation and anticipated noise levels for each item,

- type and number of mobile equipment for the remainder of the Facility (the anticipated noise levels of mobile equipment is left to the noise impact consultant). It should be highlighted that all mobile equipment, including landfill, will be required to reverse as part of normal operation, thereby sounding the safety alarm activated under such conditions,

- noise data for both the 150 000 t/a Facility and expansion to 300 000 t/a, and

- noise levels for upset conditions and accidents, where applicable.

The noise levels indicated in Table C.2 are sound power levels expressed in decibels dB(A) @ 1 m unless otherwise noted. Additional attenuation measures which can be incorporated at the detail design stage include insulation, silencers, enclosures, etc. It should be noted that noise levels indicated for relief valves include the use of silencers.

The normal operating schedules of the equipment is noted on Table C.2 however the following should be noted:

- mobile equipment operates only during day shift, 5 days per week (including landfill equipment).

- General equipment such as ventilation fans operate seven days per week and may operate 24 hours per day. Process equipment associated with operation of physical/chemical treatment plant operates 5 days per week, and equipment associated with operation of incineration plant operates 7 days per week.

The noise levels indicated for the ventilation fans are lower than standard ventilation fans (as lower speed but larger fans will be suitable), therefore the noise levels generated should be similar or slightly quieter than other industrial buildings. The noise level for all other equipment was estimated based on typical values for generic types of equipment.

TABLE C.2
ANTICIPATED NOISE LEVEL

	BASE INFORMATION				INFORMATION ISSUED FOR SENSITIVITY TESTING IF FACILITY EXPANDED			
	150 000 t/a				300 000 t/a			
		NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)				NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)		
AREA AND EQUIPMENT DESCRIPTION	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT
Truck Loadout Station								
- loadout equipment	1	85	-	-	1	85	-	-
- small ventilation fans	2	70	-	-	2	70	-	-
Solidified Material Interim Storage Building								
- front end loader	1	-	-	-	1 - 2	-	-	-
- solidified material transport trucks (same 2 trucks as for truck loadout station)	2	-	-	-	2	-	-	-
- small ventilation fans	2	70	-	-	2	70	-	-
Solidified Material Conveyor								
- one conveyor c/w travelling tripper	1	85	-	-	1	85	-	-
Solidification Plant								
- medium extraction fans on roof	4 (summer operation)	85	-	-	6 (summer operation)	85	-	-
- unloading bays with doors open	-	75	-	-	-	75	-	-
- waste truck deliveries	5-7 per day	-	-	-	10-14 per day	-	-	-
- reagent truck deliveries	3 per day	-	-	-	6 per day	-	-	-
Evaporator Stack								
- stack fitted with silencer	1	63	-	-	1	63	-	-
Effluent Storage Tanks								
- outdoor pumps	1	94	-	-	1	94	-	-
Physical/Chemical Treatment Plant								
- medium extraction fans on roof	10 (summer operation)	85	-	-	13 (summer operation)	85	-	-
- small fans	10	60	-	-	10	60	-	-
- reagent truck deliveries	2 trucks/day	-	-	-	4 trucks/day	-	-	-
- evaporator cooler fan	1	90	-	-	2	90	-	-
Physical/Chemical Storage Tank Area								
- medium extraction fans on roof	4 (summer operation)	85	-	-	6 (summer operation)	85	-	-

TABLE C.2
ANTICIPATED NOISE LEVEL

	BASE INFORMATION				INFORMATION ISSUED FOR SENSITIVITY TESTING IF FACILITY EXPANDED			
	150 000 t/a				300 000 t/a			
		NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)				NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)		
AREA AND EQUIPMENT DESCRIPTION	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT
Inorganic Drum Storage & Handling Building								
- waste truck delivery	1-3 trucks/day	-	-	-	2-6 trucks/day	-	-	-
- fork lift truck (electrical)	1	-	-	-	1	-	-	-
- dumpster hauler	1	-	-	-	1	-	-	-
- medium extraction fans on roof	3 (summer operation)	85	-	-	6 (summer operation)	85	-	-
Inorganic Tank Truck Unloading Area								
- waste truck delivery	21-32 trucks/day	-	-	-	42-64 trucks/day	-	-	-
- extraction fans on roof	9 (intermittent operation)	60	-	-	13 (intermittent operation)	60	-	-
Waste Truck Holding Areas								
- all waste truck deliveries	40-44 trucks/day	-	-	-	80-88 trucks/day	-	-	-
Organic Tank Truck Unloading Area								
- waste truck delivery	5-9 trucks/day	-	-	-	10-18 trucks/day	-	-	-
Fuel Oil Storage Tanks								
- outside pumps	1	94	-	-	1 or 2	94	-	-
Incinerator Waste Receiving Tanks								
- outside pumps	2	94	-	-	2	94	-	-
- agitators	2	-	-	-	2	-	-	-
Segregated Organic Storage Tank Area								
- waste truck delivery	1	-	-	-	1	-	-	-
- outdoor pumps	2	94	-	-	2	94	-	-
- agitators	3	82	-	-	4	82	-	-
Storage Building								
- waste truck delivery	Occasional	-	-	-	Occasional	-	-	-
- medium extraction fans on roof	4	60	-	-	4	60	-	-
Incinerator Tank Farm								
- outside pumps	10-15	91	-	-	13-20	91	-	-
- agitators	7	82	-	-	8	82	-	-

TABLE C.2
ANTICIPATED NOISE LEVEL

	BASE INFORMATION				INFORMATION ISSUED FOR SENSITIVITY TESTING IF FACILITY EXPANDED			
	150 000 t/a				300 000 t/a			
		NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)				NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)		
AREA AND EQUIPMENT DESCRIPTION	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT
Piperack	-	-	-	-	-	-	-	-
Truck Wash Station								
- medium extraction fan	1	70	-	-	-	-	-	-
Truck Wash Station (Future)								
- medium extraction fan	-	-	-	-	1	70	-	-
Organic Drum Storage & Handling Building								
- waste truck delivery	2-6 trucks/day	-	-	-	4-12 trucks/day	-	-	-
- fork lift truck (electric)	1	-	-	-	1	-	-	-
- dumpster hauler	1	-	-	-	1	-	-	-
- medium extraction fans on roof	3	85	-	-	5	85	-	-
- large extraction fans	3 (emergency only)	-	90	90	5 (emergency only)	-	90	90
Drum Conveyor								
- conveyor (enclosed in gallery)	1	-	-	-	1	-	-	-
Incineration Plant								
- medium extraction fans on roof	6	70	-	-	10	70	-	-
- small fans on roof	4	60	-	-	6	60	-	-
- air cooled condensers (front wall cooling)	1	90	90	-	2	90	90	-
- air cooled condensers (dump steam)	2(Apr-Sep)	90	90	-	4(Apr-Sep)	90	90	-
- relief valves (fitted with silencers)	-	-	60 (8 valves max)	60 (8 valves max)	-	-	60 (10 valves max)	60 (10 valves max)
- waste truck delivery	1-2 trucks/day	70	-	-	2-4 trucks/day	70	-	-
- unloading bays when doors open	-	-	-	-	-	-	-	-
- ash/salt, slag & product discharge conveyor	3	85	-	-	6	85	-	-
- reagent trucks	2 trucks/day	-	-	-	4 trucks/day	-	-	-
- slag/solidified product removal (dumpster truck)	4-8 trucks/day	-	-	-	8-16 trucks/day	-	-	-
- spray drier (rotary atomizer & lump breaker)	1	85	-	-	2	85	-	-

TABLE C.2
ANTICIPATED NOISE LEVEL

	BASE INFORMATION				INFORMATION ISSUED FOR SENSITIVITY TESTING IF FACILITY EXPANDED			
	150 000 t/a				300 000 t/a			
		NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)				NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)		
AREA AND EQUIPMENT DESCRIPTION	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT
Incinerator Stack								
- top of stack	1	63	-	-	1	63	-	-
Auxiliary Boiler Stack								
- top of stack	1	63	-	-	1	63	-	-
Sanitary Sewage Plant								
- small extraction fan	1	60	-	-	1	60	-	-
Raw Water Treatment Plant								
- small extraction fans	2	60	-	-	2	60	-	-
Surface Water Pumphouse								
- small extraction fan	1	60	-	-	1	60	-	-
Firewater Pumphouse								
- small extraction fan	1	60	-	-	1	60	-	-
- small extraction fan	1 (intermittent operation)	-	85	85	1	-	85	-
Ponds	-	-	-	-	-	-	-	-
Maintenance Building								
- medium extraction fans on roof	7	85	-	-	7	85	-	-
- small extraction fans on roof	7	82	-	-	6	82	-	-
Administration Building								
- small exhaust fans on roof	9	82	-	-	9	82	-	-
Gatehouse & Weighscales								
- small exhaust fan on roof	1	82	-	-	1	82	-	-
- package air conditioners	1	90	-	-	1	90	-	-

TABLE C.2
ANTICIPATED NOISE LEVEL

	BASE INFORMATION				INFORMATION ISSUED FOR SENSITIVITY TESTING IF FACILITY EXPANDED			
	150 000 t/a				300 000 t/a			
		NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)				NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)		
AREA AND EQUIPMENT DESCRIPTION	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT
Car Park								
- staff vehicles (beginning & end of shifts)	160 staff	-	-	-	240 staff	-	-	-
Landfill Storm Detention Pond	-	-	-	-	-	-	-	-
Meteorological/Air Monitoring Station	-	-	-	-	-	-	-	-
Main Substation								
- transformers	2	85	-	-	2	85	-	-
Emergency Power Station								
- small exhaust fans on roof	1	60	-	-	1	60	-	-
- medium fans	2	-	90	-	2	-	90	-
Evaporator Ponds	-	-	-	-	-	-	-	-
Evaporator/Recycle Pumphouse								
- small exhaust fan	1	60	-	-	1	60	-	-
Emergency Road, Hydro & Gas Corridor	-	-	-	-	-	-	-	-
Landfill								
- initial landfill site development (time sound source is above grade 80-85% of shift)								
- D9 tractor(dozer attach)	1	87 @ 15 m	-	-	1	87 @ 15 m	-	-
- 637D Tandem power scrapper	6	83-85@15 m	-	-	6	83-85@15 m	-	-
- large grader	1	83 @ 15 m	-	-	1	83 @ 15 m	-	-
- D6 tractor(dozer attach)	2	86 @ 15 m	-	-	2	86 @ 15 m	-	-
- backhoe	1	79 @ 15 m	-	-	1	79 @ 15 m	-	-
- large vibratory compactor	1	80 @ 15 m	-	-	1	80 @ 15 m	-	-
- medium size compactor	1	-	-	-	1	-	-	-
Miscellaneous trucks:								
- dump trucks	2	-	-	-	2	-	-	-
- water truck	1	-	-	-	1	-	-	-
- fuel & maintenance truck	1	-	-	-	1	-	-	-
- pick-up truck	1	-	-	-	1	-	-	-

TABLE C.2
ANTICIPATED NOISE LEVEL

AREA AND EQUIPMENT DESCRIPTION		BASE INFORMATION				INFORMATION ISSUED FOR SENSITIVITY TESTING IF FACILITY EXPANDED			
		150 000 t/a				300 000 t/a			
			NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)				NOISE LEVEL FOR EACH EQUIPMENT ITEM (PWL)		
		NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT	NUMBER NORMALLY OPERATING	NORMAL OPERATION	UPSET CONDITION	ACCIDENT
- on-going site development									
(time sound	- D9 tractor(dozer attach)	1	87 @ 15 m	-	-	1	87 @ 15 m	-	-
source is	- 637D Tandem power scrapper	2	83-85@15 m	-	-	2	83-85@15 m	-	-
above grade	- large grader	1	83 @ 15 m	-	-	1	83 @ 15 m	-	-
65% of	- D6 tractor(dozer attach)	1	86 @ 15 m	-	-	1	86 @ 15 m	-	-
shift)	- backhoe	1	79 @ 15 m	-	-	1	79 @ 15 m	-	-
	- large vibratory compactor	1	80 @ 15 m	-	-	1	80 @ 15 m	-	-
	- medium size compactor	1	-	-	-	1	-	-	-
	- dump truck	1	-	-	-	1	-	-	-
	Miscellaneous trucks:								
	- water truck	1	-	-	-	1	-	-	-
	- fuel & maintenance truck	1	-	-	-	1	-	-	-
	- pick-up truck	1	-	-	-	1	-	-	-
- daily operations									
(time sound	- D8 tractor(dozer attach)	1(80% of shift)	85 @ 15 m	-	-	1(80% of shift)	85 @ 15 m	-	-
source is	- vibrating compactor	1(50% of shift)	80 @ 15 m	-	-	1(50% of shift)	80 @ 15 m	-	-
above grade equ't working	- rubber tired or tracked loader	1(20% of shift)	83 @ 15 m	-	-	1(20% of shift)	83 @ 15 m	-	-
in landfill 70% of shift	- haulage trucks (for solidified mass)	2(100% of shift)	-	-	-	2(100% of shift)	-	-	-
haulage &	Miscellaneous trucks:								
misc. trucks	- water truck	1	-	-	-	1	-	-	-
- 80-100% of	- fuel & maint. truck	1	-	-	-	1	-	-	-
shift)	- pick-up truck	1	-	-	-	1	-	-	-
- disposal of excess excavated material (at year 10)									
	- haulage trucks	10(48 trips/ day)	-	-	-	10(48 trips/ day)	-	-	-
Pumphouse at Welland River									
- small exhaust fan		1	82	-	-	1	82	-	-
- raw water make-up pumps (inside building)		2	-	-	-	2	-	-	-